

THE RESOURCE AVAILABILITY AND WORK FIRST USE AMONG LOW-INCOME
MOTHERS IN NORTH CAROLINA

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ABSTRACT

JUNGWON HUH: The Resource Availability and Work First Use among Low-Income Mothers in North Carolina
(Under the direction of Dr. Dean F. Duncan)

This study investigated the effect of neighborhood characteristics and the accessibility to quality child care facilities and social services on the stay on Work First in North Carolina. Neighborhood has long been considered as major to the well-being of marginalized populations in the social work field, but not fully appreciated due to methodological limitations. Given the expanded funding for Child Care Subsidy under the post-Welfare reform era, the effect of the accessibility of subsidized child care is not fully investigated. This study employed the Geographical Information System to measure the accessibility to quality child care facilities in North Carolina. The study findings are 1) Work First participants in the east as well as the mountain areas in the west had limited accessibility to subsidized quality child care facilities, and 2) the effects of physical accessibility to quality child care facilities and neighborhood affluence on the length of Work First stay varied by participants' race/ethnic groups. Finally, discussion and implications follow.

I dedicate my dissertation to my mom, Hye-Sook Byun

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INTRODUCTION

THE RESOURCE AVAILABILITY AND WORK FIRST USE AMONG LOW-INCOME MOTHERS IN NORTH CAROLINA

Fundamental changes in the U.S. system of public welfare have invited public and scholarly debate about poverty and welfare in the nation. A major philosophical shift in how the nation cares for its neediest citizens brought sweeping reforms to the American welfare system during the 1990s (Blank, 2002), which culminated in the passage of the 1996 Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA). Most states had fully implemented these reforms by 1997, replacing the Aid to Families with Dependent Children (AFDC) program with the Temporary Assistance for Needy Families (TANF) program (Sawhill et al., 2002). The TANF program built on a series of state-level reforms (e.g., state waiver) instituted prior to PRWORA and restructured the system of welfare benefits, introduced time limits and lifetime benefit caps, and strengthened requirements for mandatory participation in work-related activities (Blank, 2002; Offner, 2002).

As new programs and structures were developed, states also conducted a number of evaluations of their TANF programs (Duncan, 2002; Duncan et al., 1999; Sawhill et al., 2002). State-level TANF evaluation efforts were aimed at informing development of support services that aimed to move recipients from welfare to employment, including health insurance (Anderson et al., 2004; Chavkin et al., 2000; Seccombe et al., 2007), child care (Hirshberg & Fuller, in press; Pearlmutter & Bartle, 2003; Robins, 2007; Zaslow et al., 1998), and transportation services (Deka, 2002). Most often, these evaluations examined

demographic and human capital factors (e.g., age, race, ethnicity, education, physical and mental health, and age of dependents), to determine the roles of such factors in helping or hindering welfare recipients' exit from TANF (Blank & Ruggles, 1994; Danziger, 2001; Seefeldt & Orzol, 2005; Nam, 2005; Taylor & Barusch, 2004),

Researchers rarely investigated characteristics beyond individual- or family-level factors. Moreover, the few extant investigations of macro factors tended to examine factors in isolation rather than within a comprehensive research framework. Specifically, the association between TANF recipients' use of welfare and neighborhood or neighborhood characteristics has seldom been examined. This gap in policy research stands in sharp contrast to other fields such as sociology (Clampet-Lundquist & Massey, 2008; Katz et al., 2001; Ludwig et al., 2008; Sampson, 2008; Sampson et al., 2002), economics (Brueckner & Zenou, 2003; Kling et al., 2007; Mills & Hazarika, 2003), and public health (Kawachi et al., 1997; Kim et al., 2006) in which the neighborhood context is recognized as an important contributor to individual outcomes.

Few studies have tested a comprehensive model that considers the individual or familial context of welfare recipients' lives as well as considers recipients' sociopolitical environment. Since the advent of welfare reform, comprehensive models have been critical for providing a practical understanding of the ways in which social services interact to promote economic self-sufficiency of TANF recipients. Whereas AFDC provided similar benefits and services to all recipients, using funding directly from the federal government as an entitlement program, PRWORA, gave funds for welfare support to the states as a block grant (Blank, 2002). Indeed, a primary aspect of PRWORA was the transfer of authority for welfare programs from the federal government to the states. Under PWORA, states were

given the authority to interpret, create, and manage their own welfare programs (Sawhill et al., 2002). This devolution of welfare authority resulted in considerable variation across states in the TANF rules, benefits, and services available to recipients. This variation among state TANF programs makes national-level evaluation research on TANF challenging and limits the value of many evaluation efforts (Cancian et al., 2002).

The variability of TANF programs across states makes one of the long-standing questions in the field evermore critical: how important is the place where people live, particularly for residents in need? This question was the starting point of this study. It has been well-established that no human being lives in isolation, and therefore, human behavior must be understood within both historical and societal contexts. Social science researchers have faced several methodological challenges that have limited their ability to identify the links among various social-environmental factors and the well-being of low-income individuals and families (Coulton, 2003).

This study used longitudinal administrative population data from participants in Work First, which is the North Carolina TANF program. In addition, geographic information systems (GIS) technology was used as an innovative method to measure neighborhood effect. Longitudinal population data and rigorous methods were employed to allow the investigator to reveal the effect of the neighborhood on participants' enrollment in Work First.

THEORETICAL FRAMEWORK

Work First and Neighborhood Context

Many studies investigating the job performance of welfare recipients have focused on individual and familial factors (Blank & Ruggles, 1994; Danziger, 2001; Nam, 2005; Seefeldt & Orzol, 2005; Taylor & Barusch, 2004). These studies have identified both specific individual and family level factors that act as barriers to recipients' exit from welfare to the labor force, including prior work history and education level (Nam, 2005), physical and mental health status (Taylor & Barusch, 2004), and health or behavioral health problems of a dependent child (Danziger, 2001; Nam, 2005). Some studies have argued that human capital factors (e.g., education and prior work experience) have less effect on welfare exit than demographic factors, including age, race/ethnicity, number of children in the household, and having dependent children younger than 5 years old (Blank & Ruggles, 1994; Danziger, 2001; Seefeldt & Orzol, 2005; Taylor & Barusch, 2004).

Social Capital and Collective Efficacy

The concept of social capital is not a new idea to social scientists (Porte, 1998). The beneficial consequences of social networking and group involvement have been well recognized. Numerous studies have emphasized social support as a potential buffer between adverse life events and the well-being of individuals and families (Aranda et al., 2001; Brehaut et al., 2009; Mowbray et al., 2005; Nicholson, 1997). Like social capital, social support has attracted the attention of researchers and policy makers because non-monetary

resources play a critical role in individuals' success and well-being and because social support seems an inexpensive solution to social problems (Porte, 1998).

One of the distinguishing features of social capital is that it is a publicly available resource. While social support is considered to be individually owned and consumed, social capital refers to public goods. Social support has been investigated by numerous researchers as a potential buffer between adverse life events and individuals and their families, but it has been analyzed at the individual level in most studies (Aranda et al., 2001; Brehaut et al., 2009; Mowbray et al., 2005; Nicholson, 1997). Because social support is considered to be a resource that belongs to an individual, it is characterized as private goods.

Collective efficacy might provide a theoretical explanation for why the neighborhoods with fewer social resources, including social capital, reduce the well-being of marginalized populations. Sampson and colleagues (1997) suggested that collective efficacy is a "social process" that explains the relationship between the geographic concentration of crime incidence and neighborhood composition. They further define collective efficacy as a process of "social cohesion and social trust among neighbors combined with the willingness to intervene on behalf of the common good" (1997). Social cohesion and social trust are considered to be key components of social capital by many researchers (Kawachi et al., 1997; Kim et al., 2006). Social capital becomes a valued public good, but only when it is linked to the promotion of collective efficacy, which in turn enhances social capital (e.g., social trust or social cohesion).

In summary, social capital is seen as a public good, and its supply generates collective efficacy (Kawachi et al., 1997). Collective efficacy is the social process through which it is possible to achieve shared goals for the common good. Collective efficacy has been found to

be a critical apparatus in health (Coburn, 2000; Kawachi et al., 1997), safety and crime incidence (Sampson, 2004; Sampson et al., 1997), and the well-being of children and youth (Goddard et al., 2004). However, the role of social capital and collective efficacy in studies of self-sufficiency of very low-income households is not fully understood. Collective efficacy and social capital may be more important to welfare recipients in attaining economic independency than to people with moderate or higher income, because the former have very limited human capital and may have disadvantaged demographic and familial statuses. Welfare recipients may also have limited time and expenses available to invest in creating a social network and to ask for urgent help when needed. Therefore, to people who have very limited individual resources and social networks, publicly available resources (e.g., public goods achieved by collective efficacy) are more critical to their ability to maintain their economic status when adverse life events come.

Interaction of Locality and Factors Affecting TANF Exit

Other research has shown the extent to which individual or family-level factors affect welfare recipients' exit to work differed depending on geographical location and characteristics of the community in which they lived (Harris & Parisi, 2008; Mills & Mazarika, 2003). If two low-income mothers were faced with identical individual barriers, the extent to which those barriers might hinder each woman's achievement of employment would vary based on the characteristics of the neighborhood where each woman lived. For example, as compared with urban centers, nonmetropolitan areas often have lower costs of living and lower costs associated with workforce participation (e.g., child care costs); however, nonmetropolitan areas also offer lower hourly wages and more limited opportunity

for stable employment than urban centers (Mills & Mazarika, 2003). Nonmetropolitan areas typically have limited availability of affordable child care, which increases the costs of labor force participation for welfare recipients in these locations (Harris & Parisi, 2008; Parisi et al., 2003). Therefore, the type of locality where welfare recipients' live might ameliorate or exacerbate the influence of individual barriers on welfare exit.

Race/Ethnicity and locality

The effect of race/ethnicity on welfare exit also varies by type of locality. Using administrative data for all TANF recipients in Mississippi from 1996 to 2004, Parisi and his colleagues (2006) showed community conditions were more likely to be associated with African Americans' exit from TANF than for their white counterparts. These researchers found that for African American TANF recipients, all neighborhood effects (e.g., monthly unemployment rates; percentages of workers in the manufacturing industry, service, and retail industries; metro vs. non-metro residential areas) and community faith-based activities were statistically significant. For white TANF participants, only two community variables were significant: the percentages of workers in service and manufacturing industries and those living in a suburban residence area. More important, Parisi et al. found that greater numbers of African American recipients lived in disadvantaged counties than white TANF recipients, even though study results showed community factors were more critical to TANF exit for African Americans.

Gender and locality

Equally important, gender affects TANF exit because gender plays a complicated role in economic self-sufficiency. Feminist geographers have documented the relationship between location and gender by investigating the ways in which gender affects mobility (i.e., decision of location) and have found women were less mobile than men (Gilbert, 1998). Given that women typically fulfill more domestic responsibilities than men, women are more likely to prefer a short commute from home to work; however, this preference further limits women's employment opportunities (Johnston-Anumonwo, 1995). Although previous research had argued that greater mobility translated into greater self-determination, Gilbert's (1998) study of low-income Massachusetts women (i.e., who received AFDC at some point in their lives) argued that the relationship between mobility and self-determination was neither linear nor unidirectional. The relationship varied by race. Unlike previous studies, Gilbert included mileage related to child care in her calculation of a woman's work commute, but confirmed that women were more likely than men to perform a short trip to work. Many empirical studies found that female workers' commute between residence and work was significantly shorter than their male counterpart's. Gilbert found that many women considered the distance to child care as part of their total commute time. When the women made employment-related decisions, they considered not only their time commuting to work but also their time commuting to child care. Therefore, these women appeared more likely to make spatially bound decisions regarding employment.

This spatially bound orientation plays a dual role. On one hand, such orientation enables lower-income mothers to rely on informal support from close friends and neighborhood resources. For example, sixty percent of women in the study used kin-based

child care, thirteen percent used community-based child care, and twenty percent of women used neighborhood-based care. These types of child care, especially kin-based child care, often don't charge for their services and offer flexible hours. A woman's local network played a major role in finding a job, housing and child care combination. On the other hand, relying heavily on a local network might limit the woman's opportunities to find better paying jobs because the location of child care determined the location of job she could commute to everyday.

Locality and access to services

Access is a multidimensional concept that explains a person's "ability to use services when and where they are needed" (Cromley & McLafferty, 2002, p. 234; Aday & Anderson, 1981). Penchansky and Thomas (1981) discussed five aspects of access: (a) availability, which is the supply of service; (b) accessibility, defined by physical barriers such as distance, transportation, travel time, and cost; (c) accommodation, which is the effort of service providers to meet the clients' need; (d) affordability, which is related to the cost that clients are able to bear; and (e) acceptability, which is the client's perception of services.

Accessibility and affordability are frequently identified as primary barriers that impede low-income families from securing reliable child care (Anderson et al., 2004; Browne, 2000; Hirshberg & Fuller, in press; Parisi et al., 2003; Pearlmutter & Bartle, 2003). The PRWORA welfare reforms substantially expanded federal funding for child care support (Fuller et al., 2002; U.S. House of Representatives, 2001). Geographical accessibility has become more critical in the use of child care by single mothers (Gilbert, 1998) than when a relatively limited child care subsidy was available, and participation in child care programs

has had a substantial effect on the employment outcomes of single mothers who participate in TANF, especially in rural areas.

Locality and access to child care

Access to reliable and affordable child care is essential for promoting employment among female TANF recipients with children, as well as for the healthy development of TANF recipients' children (Blau & Tekin, 2007; Fuller et al., 2002). Securing reliable child care arrangement is one of the biggest challenges to employment faced by welfare and lower-income mothers (Anderson et al., 2004). Although child care is part of the cost of employment, such costs have been rarely considered in wage structure for employees. Empirical studies showed that a reduction of child care costs through child care subsidies significantly reduced time on welfare (Cochi Ficano et al., 2006) and child care subsidy recipients were more likely to be employed than non- recipients after controlling family characteristics (Blau & Tekin, 2007).

Two child care options exist for low-income families in the United States: informal home-based child care provided by friends or relatives and formal licensed child care located in settings ranging from family homes to large, commercial centers (Kratas et al., 2004; Zaslow et al., 1998). Researchers have found formal, center-based child care was preferred by distinct groups of parents, including parents who are among the working-poor class (Hirshberg & Fuller, in press), and lower-income parents with a higher maternal education level and strong prior work experience (Zaslow et al., 1998). In addition, these subgroups of parents chose formal child care more often than parents receiving welfare. Policies that offer more comprehensive and generous child care assistance are related to higher use of center-

based care than other types of care (Cochi Ficano et al., 2006). Although such findings are thought-provoking, the causal mechanism between preference for formal, center-based care and better employment outcomes (and thus welfare status) remains unclear.

Locality and Labor Market Conditions

Location is also important to understanding the effect of labor market conditions (Harris & Parisi, 2008). Even in the strong economy of the 1990s, disadvantaged areas, which are defined as having high poverty rates and high proportions of racial minorities, were less likely to realize employment increases (Swaminathan & Findeis, 2004). It means that a strong economy and the high demand for labor were not equally beneficial to every community in the country. In addition, Holzer and Stoll (2001) surveyed employers in large metropolitan areas to examine the employers' prospective and actual hiring demand for welfare recipients by race. Although employers' prospective demand for welfare recipients in suburban areas was higher than their urban counterparts, the suburban employers were less likely to fill positions with welfare recipients from urban areas than were urban employers. It was partly because researchers found the actual hiring of welfare recipients was sensitive to market conditions and accessibility (Holzer & Stoll, 2001). For example, the access to public transportation at the place of employment was the most critical factor affecting the actual hiring of minority welfare recipients. Also when employment was located far from the residences of welfare participants', welfare recipients from minority groups typically had trouble in actually getting hired even though employers stated they are eager to fill open positions with welfare recipients.

Influence of disadvantaged localities

Residing in a neighborhood that has a high concentration of households living in poverty also has a negative association with TANF recipients' welfare use. Using empirical data from a mandated workfare experiment program in Michigan, Huber and Kossek (1999) demonstrated that community distress is a stronger predictor of welfare recipients' exit from welfare rolls than either individual efforts toward work force participation or mandated work requirements. Neighborhood analysis of TANF participation in rural areas has revealed higher rates of TANF participation in communities with a high proportion of racial minorities, few faith-based activities, high concentrations of the poor, and more employment in the retail sector (which is relatively low paying employment as opposed to higher-paying jobs, such as those in the manufacturing sector; Parisi et al., 2003).

Special employment challenges of rural areas

Although rural communities have unique socioeconomic characteristics distinguishing them from urban and suburban communities, rural communities are classified based on population density and size (U.S. Census Bureau, 2002) and proximity to urban areas (U.S. Department of Agriculture, 2004). Following these criteria, many empirical studies have tended to define *rural* as being neither urban nor suburban (Weber et al., 2002). The correlation between population density and welfare use is relevant in at least two areas: labor force participation and welfare participation (Browne, 2000; Gibbs, 2002; Hirschl & Rank, 1991). Researchers in traditional spatial economics (i.e., the study of how distance affects economic behavior) have identified two major problems in the rural labor market: low population size and low employment density (Gibbs, 2002).

The problem of low employment density is the result of seasonal economies in many rural communities that cannot provide sufficient stable employment for all residents (Howell, 2002). In addition, along with the national trend, the overall rate of rural unemployment declined from 1992 to 2000, but was slightly below the employment rate of metropolitan areas (Gibbs, 2002). Nonfarm earnings in rural areas were 25% to 30% less than those in metropolitan areas (Gibbs, 2002). Residents in rural areas had fewer opportunities to find stable jobs than their counterparts in suburban and metropolitan areas, and it resulted in a lower employment rate than their counterparts in suburban and metropolitan areas. Also the amount of earning among rural workers was less than their counterpart in other regions.

The second problem of low population density is often associated with low public service participation rates in general. Welfare participation is largely based on applicants' knowledge and desire to participate: applicants must be aware of service availability, must have accurate knowledge of available services, and must be motivated and want to participate in services (Hirschl & Rank, 1999). Typically, information about welfare programs is not advertised but is more often passed by word-of-mouth from current recipients or other informants. Such word-of-mouth referral is more difficult in rural areas with low population densities, which provides fewer opportunities for informants to encounter those who might be eligible for services (Hirschl & Rank, 1999). As compared with urban areas, evidence shows rural areas have an elevated stigma against recipients of public aid (Browne, 2000). However, Hirschl and Rank (1999) found that poverty concentration has a stronger association with welfare participation than with population density.

Social Services: The Pathway to Economic Self-Sufficiency?

Social services have become a critical element of primary support for people in need in the United States. Based on policies contained in PRWORA, TANF emphasized economic self-sufficiency through employment. Although the welfare caseload and governmental spending on TANF decreased, the number of taxpayers receiving the Earned Income Tax Credit (EITC) rapidly increased, along with the federal dollars spent on the EITC program. EITC was designed as work-incentive program for moderate- and low-income working poor. Compared with the nearly \$40 billion in spending on EITC and \$10 billion on TANF in 2006, the governmental spending for social services such as job training, adult education, child care, substance abuse or mental health services, temporary emergency assistance was \$34 billion (Allard, 2009). In addition, with the passage of PRWORA, the role of private nonprofit organizations expanded because state governments were allowed to subcontract with local nonprofit organizations to provide social services (Kissane, 2003; Marwell, 2004).

Improving access to services as means to overcoming employment barriers.

A fundamental change between AFDC and TANF was the inclusion of work requirements. Whereas AFDC was an entitlement program, TANF requires recipients to be involved in work or work-related activities in order to maintain eligibility for assistance. Despite work requirements and work incentives such as EITC, many empirical studies have found that low-income single mothers suffered numerous barriers to employment, such as lack of human capital, impaired physical or mental health, and lack of access to child care and transportation (Blank & Ruggles, 1994; Danziger, 2001; Seefeldt & Orzol, 2005; Nam, 2005; Taylor & Barusch, 2004). To address such employment barriers, states increased their expenditures on child care subsidy programs and other social service programs, such as job

training, adult education, substance abuse or mental health services, and temporary emergency assistance, by transferring TANF funds to the Child Care and Development Block Grant (CCDBG) and Social Services Block Grant (SSBG; Allard, 2009).

A critical factor in the delivery of all services, including child care, is the proximity of the person in need of the service to the provider of those services; this principle is especially true for the delivery of social services (Allard, 2009; Allard et al., 2003; Joassart-Marcelli & Wolch, 2008; Peck, 2008). Unlike TANF and EITC benefits, which can be mailed or transferred electronically, receipt of most support services requires potential clients to make regular visits to service agencies to apply for and receive services (Allard, 2009). Allard and his colleagues (2003) examined the relationship between proximity to service providers and the use of mental health and substance abuse treatment services among welfare participants in the Detroit metropolitan area. These researchers found closer proximity to service providers increased the service receipt among welfare participants. Similarly, Bielefeld and his colleagues (1997) confirmed the strong relationship between the location of service and the location of service users. However, a study conducted in Southern California cities (Joassart-Marcelli & Wolch, 2003) showed the geographical patterns of nonprofit social service agencies did not consistently overlap patterns of poverty concentration, which may indicate that social service agencies that serve people in poverty were not always located where they were most needed. Many non profit social service organizations were found in older areas and city centers. While some residents moved from an urban center to a suburban area, social service agencies were not able to follow their clients (Joassart-Marcelli & Wolch, 2003).

The need for social services increases during times of economic recession (Allard, 2009). Even during the strong economic period of the 1990s when the demand for labor was relatively high, more than 30% of welfare participants reported that they sought additional help and received support from governmental and nongovernmental social service agencies (Edin & Lein, 1997). This suggested that the governmental cash benefit was not sufficient for them to achieve economic self sufficiency, and supportive social services have been identified as a critical factor to help welfare participants to exit (Cheng, 2009). Since most of the welfare recipients were female with dependent children, it was not surprising that the role of supportive social services was critical for them to achieve economic independence. An empirical study showed that the job stability of rural low-income mothers was strongly related to secure child care and transportation services (Berry et al., 2008).

The importance of neighborhood institution as resource broker

If access to services helps to determine a TANF recipient's exit from welfare to work, then increasing access to services may be an important and under addressed issue. Perhaps the current service gap can be addressed by extending the ability of welfare recipients to access to services from government agencies through resource broker. For example, existing neighborhood institutions, such as child care facilities, could serve as resource brokers in their neighborhood (Small, 2006), thus dramatically increasing the number of service access points. This concept was explored by Small (2006) in a case study with 16 child care facilities in a high poverty neighborhood of New York City. Small argued that neighborhood institutions affected resource access among people living in neighborhoods with high concentrations of poverty. Small found that although many people gained access to the resources through social networks, those in poor neighborhoods were relatively socially

isolated and, as such, neighborhood institution (e.g., child care facilities) often served as their only channel to access resources. Therefore, the lack of availability of neighborhood broker institutions could have more negative effect on lives of residents in poor neighborhood than poverty rate itself.

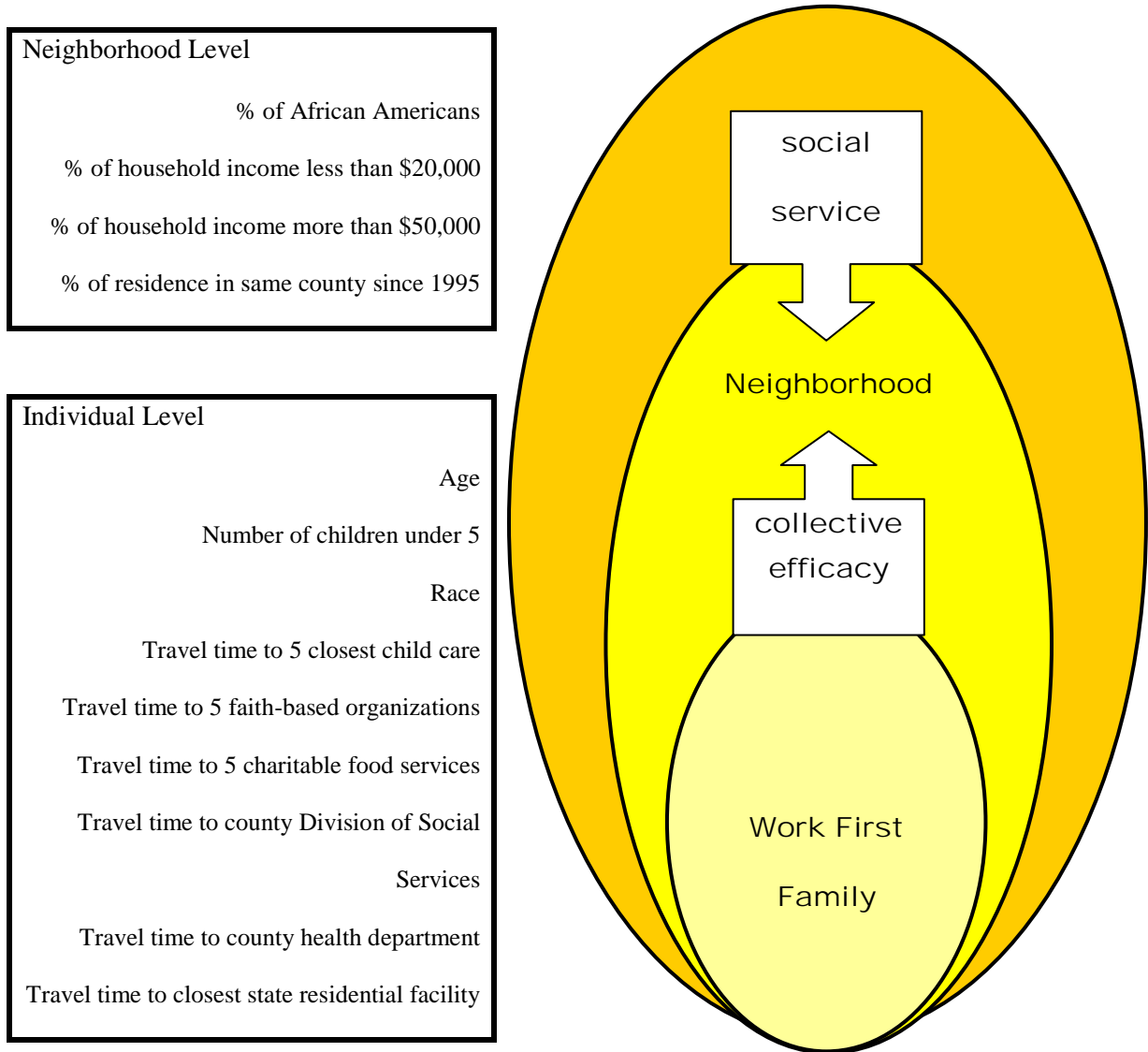
Research Framework

Figure 1 illustrates the theoretical framework used in this study. The left side of the figure delineates the nested environments of families: individual families live in neighborhoods, and those neighborhoods are nested in counties. Family, neighborhood, and county are closely connected and continually interacting with each other. Families within a neighborhood share social ties with other families. These social ties become the foundation of social cohesion and social trust in neighborhoods. Social cohesion and social trust in a neighborhood facilitate residents of a particular neighborhood willingness to intervene in cases of neighborhood disorder as well as residents' efforts toward achieving community goals. This process of trust building and goal setting is called *collective efficacy* (Browning & Cagney, 2003; Sampson et al, 1997).

Moreover, collective efficacy may increase a community's abilities to attract the attention of federal and local governments as a promising area for the location of quality social services (Browning & Cagney, 2003). Interestingly, Browning and Cagney (2003) argued from empirical analysis that neighborhood affluence has a stronger positive effect on individual health outcomes than other neighborhood characteristics such as poverty.

Figure 1

Research Framework



The left side of the figure lists selected variables that are included in the study analysis. These variables are thought to affect the length of single female participants' initial stay in Work First. The lower portion of the list illustrates individual- and family-level characteristics of single female Work First participants. Demographic characteristics (e.g.,

age of single female participant when she entered Work First for the first time, race/ethnicity, and the number of children younger than 5 years) are also included.

Neighborhood characteristics consist of two groups of variables: neighborhood attributes and accessibility. First, neighborhood attributes are classified as either urban or rural, the percentage of African Americans, the percentage of households with income less than \$20,000, and residential mobility (i.e., the percentage of residents in same county since 1995). These variables are measured at the Census-tract level.

The second part of neighborhood characteristics is individually measured neighborhood characteristics: accessibility to state-accredited child care facilities. Previous studies argued that when formal, center-based child care is available, accessible, and financially feasible, low-income families choose center-based child care (Crosby et al., 2005; Fuller et al., 2002). In North Carolina, a woman with dependent children who is qualified for Work First can receive generous child care assistance. Women receiving Work First child care assistance pay less than 10% of child care fees out-of-pocket, with the remaining costs reimbursed by Work First. In light of this generous assistance, it can be assumed that Work First families do not face financial barriers to quality child care. Therefore, only physical accessibility—and not financial accessibility—was included in the study analysis.

Research Questions and Hypotheses

This investigation was guided by three research questions.

1. To what extent are service providers including county social services, nonprofit food service organization, faith-based organizations, and child care facilities that accept Work First vouchers in North Carolina physically accessible to Work First participants?

2. What is the neighborhood influence on the length of stay in Work First among Work First participants who are single mothers or primary caregivers of dependent children?

This research tested following hypotheses that addressed components of the research questions.

- 1) Neighborhood characteristics of Work First participants' area of residence are related to speed of exit from the Work First program.
- 2) Work First proximity to child care facilities is related to speed of exit from Work First.
- 3) Participants' proximity to faith-based organizations is related to speed of exit from Work First.
- 4) Participants' proximity to food banks or food pantries is related to speed of exit from Work First
- 5) Participants' proximity to a county department of social services office is related to speed of exit from Work First
- 6) Participants' proximity to a county health department office is related to speed of exit from Work First
- 7) Participants' proximity to residential facilities is related to speed of exit from Work First.
- 8) Interactions between Work First participants' individual demographics (race and number of children younger than 5 years) and proximities are related to speed of exit from Work First.

- 9) Cross-level interaction between Work First participants' demographic characteristics (race and number of children younger than 5 years) and neighborhood characteristics are related to speed of exit from Work First.

METHODOLOGY

Data sources

The data of this study came from four sources: the North Carolina Division of Social Services, Census data, National Center for Charitable Statistics at Urban Institute, and the North Carolina Department of Health and Human Services. The main data, Work First participants' information, came from the North Carolina Division of Social Services. The data are managed by the Jordan Institute for Families at the School of Social Work at the University of North Carolina at Chapel Hill. Data are updated monthly based on a check history file from the Eligibility Information System (EIS).

The raw data are used to generate two monthly data files: a case file and an individual file. When a household enters Work First for the first time, a case ID is assigned to each case, and each individual in the case who is eligible for Work First is assigned their own individual ID. Both IDs are permanent. However, while each person is supposed to have only one individual ID, that person could have more than one case ID. For example, imagine a mother and her two minor children, and all of them had qualified for Work First when they entered for the first time. Then the mother left Work First due to incapacitation, sanction, or time limits, and her children might have moved into other living settings, such as relatives' houses or other state-approved settings. Then the children might have opened new cases and been assigned new case IDs, or one of children might have kept the old case ID and the other child might have opened a new case.

The procedure of data building started from the case file. I selected cases that opened their first spells between January, 2008, and December, 2008, and stayed on Work First at least two consecutive months to avoid administrative errors. The cases that consisted only of children (i.e., child-only cases) were excluded. This is called the 2008 Cohort Case File. The 2008 Cohort Case File contains a case ID, monthly participation variables (participated=1, did not participate=0), and a beginning spell (e.g. first month when a case entered to Work First) per case.

Then all individuals who have the same case IDs were extracted to gather individual/demographic information, such as gender, family status (i.e., biological parent, child, adoptive parent, grandparent, other relatives), age, and race/ethnicity of all individuals. A total of 19,063 individual information cases were extracted. Individuals' ages were calculated in January 2008. Based on family status variables, individual data were divided into two files; one was a mother file and the other was a child file. From the child file, a number of children under 5 years of age per case and a number of children under 18 years of age per case were calculated and then merged into the parent file. The address information was also extracted based on the case IDs from the raw data file. Then this information was merged into the 2008 Cohort Case File. The total number of the mother files was 5,070.

The neighborhood data was collected from various sources. The interest of this study is the proximity to quality child care facilities and social service agencies for each Work First mother. To generate the accessibility to quality child care facilities, the addresses and state-accredited information of child care facilities were needed. The North Carolina Division of Child Development provides the child care search tool, which provides the comprehensive list of childcare facilities based on criteria users select, such as city or county, types of

facilities (e.g. center-based or family home care), rank of the state-accredited system (five stars is the highest rank and one star is the lowest), the type of license, and contact information. The contact information includes a facility name, address, telephone number and/or email address, name of director, and license number.

To generate the proximity to county social service agencies, the addresses of each county department of social services and county health department were gathered from the North Carolina Division of Social Services. Also the information and addresses of other residential facilities, such as developmental centers, ADATCs, regional hospitals and schools for people with hearing or vision disabilities, were downloaded.

The information and addresses of food bank or soup kitchen data and faith-based organizations were downloaded from National Center for Charitable Statistics (NCCS) at Urban Institute. NCCS provides data mainly on the form 990 for non-profit organizations filed for the IRS. The data contains the descriptive information about all tax exempt entities of the United States on the Business Master file of IRS (Frasier, 2004). The non-profit organizations of the data were classified by standard National Taxonomy of Exempt Entities (NTEE) code (Pollak & Lampkin, 2001). NTEE code K indicated the non-profit organizations provided food services (food bank, soup kitchen, or food pantry) and NTEE code X indicated faith-based organizations (church, or temple). Those two categories were chosen to include in the study because they were the most critical non-governmental services for low-income single mothers. The addresses and information of 109 food service organizations and 4682 faith based organization in North Carolina were gathered.

Finally, demographic and economic information for each Census tract were downloaded from the 2000 Census. Specifically, information about neighborhood affluence

and poverty (i.e., percentage of households with income less than \$20,000 and the percentage of households with income greater than \$50,000), residential mobility, and racial/ethnic heterogeneity (percentage of African Americans) was retrieved. All data was downloaded with a census tract code to be merged into the final data set

Data processing and GIS

Geographical Information System (GIS) refers to a system of hardware and software used to capture, integrate, map, and analyze spatial data (Longley et al., 2001). GIS is a promising tool for measuring individual-level neighborhood variables. First emerging in the 1960s, GIS has evolved into a respected technological field and a popular research tool in many fields such as public health, social policy, and sociology to illuminate patterns and relationships in real-world problems. GIS makes it possible to locate the residential area of the Work First population and to visualize the socio-economic characteristics of their neighborhood. Moreover, GIS provides the ability to calculate the accurate distance to child care facilities from individual residential locations with a consideration of the geography (e.g., roads and natural barriers, such as one-way restrictions, speed limits, rivers or mountains), not just simple direct distances between two locations.

The first step was to locate individuals' houses on the map through the geo coding process of ArcGIS. The ArcGIS program assigns X and Y coordinates to each address through an automatic geocoding process. For each address, ArcGIS provided candidate locations with a matched score (0 is no matching, 100 is perfectly matched). The match score is calculated based on each segment of the whole address. I set the advanced setting of one's score above 62 as matching. After the first attempt of automatic geo coding, 3,383 (67%)

were matched and 1,687 (33%) were not matched. I manually reviewed all candidates for the 1,687 unmatched addresses to find out if any candidate yielded the correct location of the address despite a low score. After this procedure, 3,728 (73%) addresses were matched and 1,342 (26%) addresses were unmatched. Among unmatched addresses, I found that 434 participants had post office boxes instead of street addresses, 211 addresses were missing, and 9 were not North Carolina addresses. Among a total of 5070 parents, 691 addresses were matchable, but still unmatched. I searched Google maps for these 691 addresses to find their X and Y coordinates and typed X and Y coordinates of 631 addresses I found from the internet mapping tools into an Excel work sheet. This Excel file was imported into ArcGIS and combined with previously matched addresses. The final sample with the matched addresses was 4365, because 54 couldn't be located by any of the currently available mapping tools, such as Google, Bing, or Yahoo Maps.

Next, a similar mapping procedure was applied to the addresses of child care facilities. First, I searched the child care facilities in all 100 counties in North Carolina. I selected only child care facilities which were center-based or home care and received more than three stars from the state government. A total of 4834 child care facilities were identified; this number excludes 24 facilities whose addresses were not published at the North Carolina Division of Child Development website due to the providers' requests, and it was impossible to find their addresses through any of the searching tools. Then the same geocoding process was followed as one with Work First participants. A child care ID (CCID) was assigned to each child care facility. Also same process was conducted to geocode county social service offices, charitable food service organizations, and faith-based organizations.

The next step was to calculate the accessibility from a residential address to child care facilities, county social service offices, charitable food service organizations, and faith-based organizations. ArcGIS provides a couple of tools to find the best route and to calculate travel time between two locations: the closest facility tool and OD cost matrix tool. The best route could be the shortest one, quickest one, one without entering a highway, or whatever route was generated by chosen impedances. Two methods execute very similar analysis and the difference is in the output presentation. Whereas the closest facility tool takes longer time and memory because it shows the all true routes it generated in the output presentation, OD cost matrix generates quicker output but returns only travel time and distance without showing true routes. This study has chosen an OD cost matrix tool because the study needs only travel time and doesn't need to present true route or driving directions between residential locations of Work First participants' and social service locations or child care facilities. Moreover, it reduced the analysis time and memory to avoid a computer crash.

The OD cost matrix analysis needs accurate network analysis data, which contains information about the speed limit of each road, restricted U turns or one-ways, elevation, and roads and barriers. Users have flexibility to set criteria. For example, the OD cost matrix tool would identify routes based on a series of restrictions, such as travelling only on local roads, no highway driving, and no use of a trolley or ferry. In this analysis, the author set the criteria of the OD cost matrix tool to consider one-ways and U-turns when calculating the quickest travel times. The OD cost matrix tool generated five variables of travel time in minutes and five variables of distances to five of the closest child care facilities, five of the closest faith-based organizations, five of the closest charitable food service agencies, the county

department of social services, the county health department, and residential facilities run by the North Carolina Department of Health and Human services.

Even though the OD cost matrix analysis required less memory, ArcGIS still had difficulty generating the time and distance variables for all 4365 participants with 4365 child care facilities. To address this problem, 9 separate Excel tables were made, each containing 500 Work First participants, and separate OD cost matrix analyses were run for each. All of the results were then combined and transposed to be merged.

The next step was to identify the census tract numbers where each Work First participant lived in order to merge the neighborhood attributes into a data set. First, a census demographic map was loaded in the ArcGIS. This map was provided by the U.S. Census Bureau and contained demographic information at the census-tract level. The Work First participants' residential location layer was loaded on the census demographic map. Then Work First participants' residential locations were spatially joined into the census map. Through this process, Work First participants were assigned a census tract number.

The final step was to merge all the data into a single dataset. The Work First 2008 Cohort Case File contained the case information (cased months of the first stay on Work First, race/ethnicity, number of children under 5, and ages in 2008). The child care accessibility file contains cased and the result of the OD matrix analysis (travel times and distances to the 5 closest child care facilities, and the number of stars each facility received from the NC state government). The third data had cased, a census tract number, and neighborhood attributes (percentage of African Americans, percentage of households with income less than \$20,000, percentage of households living in the same county since 1995, and Rural Urban Commuting area codes).

Variables and measures

Months of first stay on Work First: It is the number of months calculated from the time at which the first formal Work First case was opened until the exit from Work First. To avoid administrative mistakes, at least three consecutive months of non-participation is considered to be an exit (Luks & Brady, 2003; Nam, 2005).

Total travel time to 5 closest child care facilities: This variable is generated by the previously described GIS process. As described in the data process, I generated travel times to the 5 closest child care facilities and calculated the sum of the 5 travel times. Total travel time might be considered as a more appropriate proxy of child care accessibility than the travel time to the closest child care facility because no examples exist in which child care was actually chosen by the participant. Moreover, researchers emphasized that many of the child care services often couldn't accommodate a low-income mother's child care needs (Fochi ; Gilbert, 1998). Welfare mothers were likely to work irregular hours or change their shift frequently, so they needed to switch child care providers to serve different times whenever their work schedule changed.

Total travel time to 5 closest charitable food service organizations: This variable is also generated by the OD cost matrix tool of ArcGIS. I have chosen the five closest charitable food service organizations, such as food banks, food pantries, or soup kitchens then calculated travel time from each Work First participants' residential location to each food service and added all of them.

Total travel time to 5 closest faith-based organizations: this variable is the sum of 5 travel times from Work First participants' residential location to the 5 closest faith-based locations, such as churches or temples.

Travel time to county Department of Social Services: This variable is travel time from Work First participants' residential location to the county department of social service office.

Travel time to county health department: This variable is travel time from Work First participants' residential location to the county health department office.

Travel time to closest North Carolina residential facility: This variable is travel time from Work First participants' residential locations to the closest North Carolina residential facility, such as Alcohol and Drug Abuse Treatment Centers (ADATCs), developmental centers, Neuro-medical treatment centers, psychiatric hospitals, schools for the blind and schools for the deaf.

Age is a female single mother's age on January 1, 2008, when they entered the Work First program for the first time.

The number of children under 5 years old is the number of dependent children who were younger than 5 years old.

Black is a dummy of race/ethnicity of female single participants. The value 1 indicates African American and value 0 is other race/ethnic. The sample description said that 2545 (58.3%) of sample were African Americans, 1450 (33.22%) were non-Hispanic Whites and only 370 (8.78%) identified other racial and ethnic groups. This analysis focused on the effect of independent variables on African American Work First participants when compared to other racial/ethnic groups, including non-Hispanic White participants.

The percentage of households with income under \$20,000 is an indicator of the neighborhood concentration of poverty and extracted from the U.S. Census Bureau. The concentration of poverty is seen as a major factor which leads low-skilled, minority residents into social isolation (Small, 2007; Wilson, 1987).

The percentage of African Americans is considered as an indicator of minority concentrations (Small, 2007; Wilson, 1987).

The percentage of same residence since 1995 measures Residential stability. is entered as a factor promoting social trust in a neighborhood (Browning & Cagney, 2003; Sampson et al., 1999; Wilson, 1987). Residential stability is defined as residence in the same county since 1995..

The percentage of households earning more than \$50,000 is expected to indicate the proportion of affluent households in a neighborhood. Neighborhood affluence also has a positive effect on individual outcomes (Browning & Cagney, 2003; Robert, 1999).

Table 1

Data Sources and Variables

Name	Source	Variables	Description
Work First case file	North Carolina Division of Social Services	fstay5	Months of the first stay on Work First
Work First individual file	North Carolina Division of Social Services	black	African American (1) or not (0)
		nunder5	Number of dependent children under 5 years old
		age	Age
501c file	National Center	fdtotime	Total travel minutes to 5 closest

	for Charitable Statistics		charitable food service agencies
		chtottime	Total travel minutes to 5 closest faith-based organizations
Child care location	North Carolina Division of Child Development	totttime	Total travel minutes to 5 closest high quality subsidized child care facilities
County social service	North Carolina Division of Social Services	dsstime	Travel minute to county department of social services
County health department	North Carolina Division of Social Services	hdtime1	Travel minute to county health department
Residential facilities	North Carolina Department of Health and Human Services	rftime1	Travel minute to residential facilities managed by North Carolina Department of Health and Human Services, such as Alcohol and Drug Treatment Centers, Developmental centers, Neuro-medical treatment centers, Psychiatric Hospitals, Residential programs for children, School for the Blind, School for the

			Deaf
2000 Census data	U.S. Census Bureau	pctl20k	% of households whose income less than \$20,000
		pctm50k	% of households whose income more than \$50,000
		pctbl	% of African Americans
		pctrmo_c	% of same residences since 1995

Neighborhood attribute variables are calculated on the census tract level. The census tract has been used in many empirical studies as a proxy of communities or neighborhoods (Krieger et al., 2002b; Prentice, 2006; Robert, 1998). A census tract has a reasonable number of residents (generally 4,000 to 5,000) and does not cross administrative boundaries, such as a county or city boundary (Krieger et al., 2002b) or natural boundaries, such as river, lake or mountain (Prentice, 2006). Whereas zip codes were designed by the United States Postal Service to maximize delivery efficiency (Krieger et al., 2002), census units were created by the United States Census Bureau as stable statistical subareas of counties with an aim to respect the homogeneity of political and socioeconomic characteristics among the population (U. S. Census Bureau, 2008). Therefore zip codes often cross administrative and census boundaries, but census units respect political border lines. A block group is a subdivision of a census tract, containing an average of 1,000 residents, whereas a full census tract has an average of 4,000-5,000 people (Krieger et al., 2002b). Krieger and her colleagues explored the relationship between health-related indicators and a variety of socio-demographic factors

to answer the question of which geographic unit is suitable for public health research (Krieger et al., 2002a; Krieger et al., 2002b; Krieger et al., 2003). They suggested that census tracts and block group socioeconomic measurements detected the gradients of health outcome indicators, while zip code area measurements showed poor performance.

Analysis

This study employed two methods to answer the research questions. First, Geographical Information Science (GIS) refers to a system of hardware and software used to capture, integrate, map, and analyze spatial data (Longley et al., 2001). GIS is a promising tool for measuring individual-level neighborhood variables. First emerging in the 1960s, GIS has evolved into a respected technological field and a popular research tool in many fields, such as public health, social policy, and sociology to illuminate patterns and relationships in real-world problems.

The benefits of GIS in social work practice have been demonstrated through increased capacity to tailor services to meet the needs of individuals (Hiller, 2007). For example, GIS can be used to generate a personalized map based on each client's home address showing the location of relevant services and resources. In addition, GIS can be incorporated into social work practice in evaluating existing service delivery and patterns and locating new service sites for outreach (Roberson & Wier, 1998). Social work agencies and state agencies have increasingly begun to incorporate GIS into routine practice, service, and evaluation protocols. However, the field of social work has been slow to adopt GIS as a research tool.

GIS shows potential for social work research. Hiller (2007) has argued that GIS is an appropriate tool for social work research because GIS strengthens the social survey tradition that originated with Jane Addams and other social work pioneers. Hiller also noted that GIS incorporates the ecological perspective in which many social work studies are grounded. GIS can be used in social service research in three ways. First, GIS provides insight to the spatial pattern of population studies, showing the relationship of people to their environment prior to conducting data analyses with advanced spatial methods. Along with the recent popular use of multi-level analysis in sociology, public health, demography, and other social science fields that recognize the nested characteristics of data and the importance of neighborhood and community characteristics on individual outcomes, more and more social work researchers include neighborhood or contextual characteristics in their analyses. Researchers using GIS to investigate the distribution of raw data to find patterns or outliers can generate neighborhood data maps revealing spatial patterns that would remain hidden in table-formatted data. For an example of how a spatial pattern provides insight into the evaluation of service efficiency, Robertson and Wier (1998) showed a geographical dimension to service delivery that suggests service efficiency in a given county is affected by the availability of services in neighboring counties, with a map including spatial pattern of service delivery in neighborhood counties.

Second, GIS can be used to obtain more accurate measures of neighborhood characteristics for statistical analysis through the geocoding process. Geocoding refers to “the process identifying an address’s latitude, longitude, and assigned geographic codes, which in the United States includes its census-defined state, county, census tract, and block-group codes, along with codes for political jurisdictions” (Krieger et al., 2003). Many analyses of

neighborhood effects include aggregated measures of neighborhood characteristics..

However, as discussed previously, area-based aggregated measures work well in some cases but may be inappropriate for some research questions.

Moreover, GIS can generate distance estimates with great accuracy in terms of real-world, point-to-point travel. For example, if a researcher is investigating the effects of a new job-training service on the job achievement of welfare recipients, an important covariate is the accessibility of job services. Researchers can employ GIS to calculate driving distances rather than direct distances, an important advantage. This type of information will contribute to better understanding the relationship between program outcomes and the physical accessibility of social service programs.

Third, GIS gives researchers flexibility in measuring natural and built environment features of a neighborhood. With the current boom of using GIS, a growing number of local governments provide GIS data containing various information about demographic characteristics of residents, the natural environment (e.g., water shed, land use, etc.), and social services (e.g., local outreach of social service agency, parks and recreation facilities). Researchers select the information they need and set the level of area they want, such as census block, census tract, county, or the area they desire.

Among many GIS analysis tools, this study will employ Moran's I index. Moran's I, developed by P.A.P. Moran (1950), was used to assess the spatial autocorrelation among neighborhoods regarding the distribution of high quality subsidized child care, faith-based organizations, and charitable food service agencies. Moran's I is one of the most expansively used measures to detect spatial independence in spatial analysis (Assuncao & Reis, 1999; Boots & Tiefelsdorf, 1999).

There are two kinds of Moran's I index: Global Moran's I and Local Moran's I. Global Moran's I is used to measure autocorrelation of the entire region, whereas local Moran's I generates a value of Moran's I for each individual area of the region (Boots & Tiefelsdorf, 1999). Local Moran's I was one of the most popular tools to identify hotspots based on the evaluation of neighboring areas (Zhang, et al., 2008). High positive value of Local Moran's I means that a census tract is surrounded by census tracts having similar numbers of child care facilities, and its low negative value indicates that a census tract is surrounded by ones with heterogeneous numbers of child care facilities.

Moran's I given by

$$I = \frac{m}{\sum_{ij} w_{ij}} \frac{\sum_{ij} w_{ij} (p_i - \bar{p})(p_j - \bar{p})}{\sum_i (p_i - \bar{p})^2}$$

where the value of w_{ij} is the weight assigned to area i and area j and usually the distance between area i and j . m indicates the number of areas in region of interest. p_i , the observed rate of incidences in area i , and \bar{p} is defined as the number of cases divided by the risk population.

In this analysis, local Moran's I was calculated for each census tract to identify the neighborhoods surrounded by neighborhoods with a similar number of social services. If one census tract suffers from a lack of social services in its own census tract, residents are likely to find the same services in the surrounding area. When two groups of Work First participants live in two different areas that suffer from a lack of social services, Work First participants who couldn't find the location of social services they needed at neighboring

areas were likely to have difficulty obtaining the services than ones who could find it at surrounding neighborhoods.

To investigate research question 3, an event history analysis was mainly conducted. Before event history analysis entered, descriptive analysis of the sample characteristics was conducted. At this part of the analysis, local variability was assessed by calculating Kaplan-Meier estimates of median times to exit from Work First for each of the independent variables and covariates.

Event history analysis is able to estimate the effect of accessibility and neighborhood characteristics on the length of stay among Work First participants. This study emphasized both the association between neighborhood attributes and Work First use and the timing of exit from Work First. Event history analysis was suitable for conducting the investigation of both pieces of information (Guo, 2010). Moreover, event history analysis has the ability to handle censored observations, or events that do not occur during the study window; whereas, an ordinary regression model loses the information of censored cases (Allison, 1995; Guo, 2010).

There are three types of censoring: left-censoring, right-censoring and random-censoring (Guo, 2010). Left-censoring means that an observation starts before the research window is unknown. Right-censoring indicates that an event has not been experienced during the study window. Random censoring means that both the observation's starting point and ending point are within the study window, but the reason for termination is not study interest (Allison, 1995; Guo, 2010). Because these data selected participants who first entered Work First in 2008 based on their participation history, there are no left-censored cases. However,

the data contain right-censored cases, such as those who didn't exit from Work First by the end of the study window..

In addition, due to the multi-level features of the data (e.g., residential locations are nested in census tracts), LWA modeling (Lee, Wei & Amato, 1992) was used to monitor the autocorrelations among participants within the same census tracts. LWA is supposed to handle models with a moderate sample size and expects subjects within the same group to have a common baseline hazard rate (Guo, 2010).

Two diagnostic tests were conducted (Guo, 2010) to identify whether the procedure to correct for autocorrelated data is needed or not. The first method suggested by Guo (2010) was intraclass correlation (ICC) to identify the extent of autocorrelation among data. The ICC is the proportion of the variance in months of first stay on Work First between neighborhoods. It was calculated by one-way ANOVA with random effect model using HLM software. HLM software generated between-group variance and within-group variance. Then the ratio of within-group variance over the between-group one was calculated. The value of the ratio would be between 0 and 1. The value of closer to 1 means the variation of Work First stays is more due to the group than due to an individual. To conduct the second diagnosis, one participant will be selected from each census tract, and their lengths of stay go into a Cox model with the rest of the samples as an independent variable with other independent variables. If the hazard rate of “duration of omitted Work First participants’ stay” is close to 1, “the duration of the omitted Work First participants’ stay” from a census tract is highly correlated with the length of the stay among the other Work First participants in the same census tract. Therefore, it means that the data have nested characteristics and the LWA model should be employed to correct the autocorrelation problem.

The analysis included the assessment of cross-level interaction along with the assessment of main effects. Both theory-driven and data-driven approaches were conducted to test cross-level interactions of the models. Race/ethnicity, number of children under 5 years old, travel time to the 5 closest high quality subsidized child care facilities, travel time to the 5 closest faith-based organizations, travel time to the 5 closest charitable food service agencies, travel time to the county department of social services, travel time to the county health department, travel time to the closest residential facility managed by the North Carolina Department of Health and Human Services were included to test cross-level interactions with neighborhood characteristics. Race/ethnicity was selected because previous research indicated that the effect of neighborhood characteristics on exit from welfare varies by race/ethnicity, especially for African Americans (Parisi, et al., 2006). Since there is minimal research on the interaction between the number of young children, proximity to child care facilities, proximity to social services and neighborhood characteristics, a data-driven approach was used. A data-driven approach assesses all possible cross-level interactions among the number of children under 5 years old, proximity to child care facilities, proximity to social services and neighborhood characteristics. Then only significant interactions remained in the final model.

Another issue is related to missing data problems. The main strategy of this study was to locate individual Work First participants' homes on the map and calculate travel times to social services, non-profit organizations, and high-quality subsidized child care facilities. The participants who couldn't be located were deleted in the analysis. Therefore, it needed to be evident whether excluded cases are informative. The majority of excluded cases (434) were excluded because of P. O. Box addresses instead of regular street addresses. It was doubtful

that the participants who provided P. O. Box addresses to case workers might have different performance characteristics or Work First performances from the ones who provided their home addresses. They might experience bigger housing instability than their counterparts who provided home addresses and this housing insecurity might have caused a delayed exit from Work First.

This study employed two strategies to address the missing data issue.

First, this study tested if there is significant difference in demographic characteristics, such as age, number of dependent children under 5 years-old and dependent variable (e.g. first stay on Work First), between two groups. Second, besides the study sample (N=4365) that consisted of Work First participants whose addresses were able to geocode, this study made another sample that consisted of both matched cases and unmatched cases. Work First participants who provided P. O. Box addresses were geocoded by zip code through the zip code address locator of ArcGIS. Then the proximity to county social services, the proximity to child care facilities, the proximity to faith-based organizations, and the proximity to charitable food service organizations were calculated. The number of this sample was 4846. The study ran the same analysis with this sample as the sample with matched cases (N=4365) to see if the two analyses would show similar results.

The dependent variable was the length of a participant's first stay of time on Work First. It was the number of months calculated from the time at which the first formal Work First case was opened until the exit from Work First. To avoid administrative mistakes, at least three consecutive months of non-participation is considered to be an exit (Luks & Brady, 2003; Nam, 2005). Independent variables are total travel time to the 5 closest child care facilities, total travel time to the 5 closest charitable food service organizations, total

travel time to the 5 closest faith-based organizations, travel time to the county department of social services, travel time to the county health department, and travel time to the North Carolina residential facility; demographic information, such as age, number of children under 5, and race/ethnicity served as covariates. Neighborhood attributes, the proportion of household income under \$20,000, residential stability, and the percentage of African Americans (Browning & Cagney, 2003; Small, 2007) were included in the analysis.

This study employed several analytical computer software programs to manage data sets and run analysis. SAS 9.1, Microsoft Excel, STATA, R, HLM and ArcGIS were used for data management. Work First participants' demographic information and Work First case information were managed by SAS 9.1 on UNIX server. Then Work First participants' information was converted into an Excel format. The information consisting of state/county social services and child care facilities were downloaded in Excel and geocoded by ArcGIS 9. The information consisting of charitable food services and faith-based organizations in North Carolina were converted into Excel format for the geocoding process. Then all the information consisting of social services, child care facilities, non-profit social service, and Work First participants were spatially joined by ArcGIS. The spatially joined data was exported in an Excel format then imported into SAS data format.

SAS was used to make variables and run preliminary analysis, such as a t-test and life test analysis. HLM software was used to run one-way ANOVA with random effect to estimate intraclass correlations (ICC). LWA analysis was conducted by STATA and R. Most graphs were generated by STATA.

RESULTS

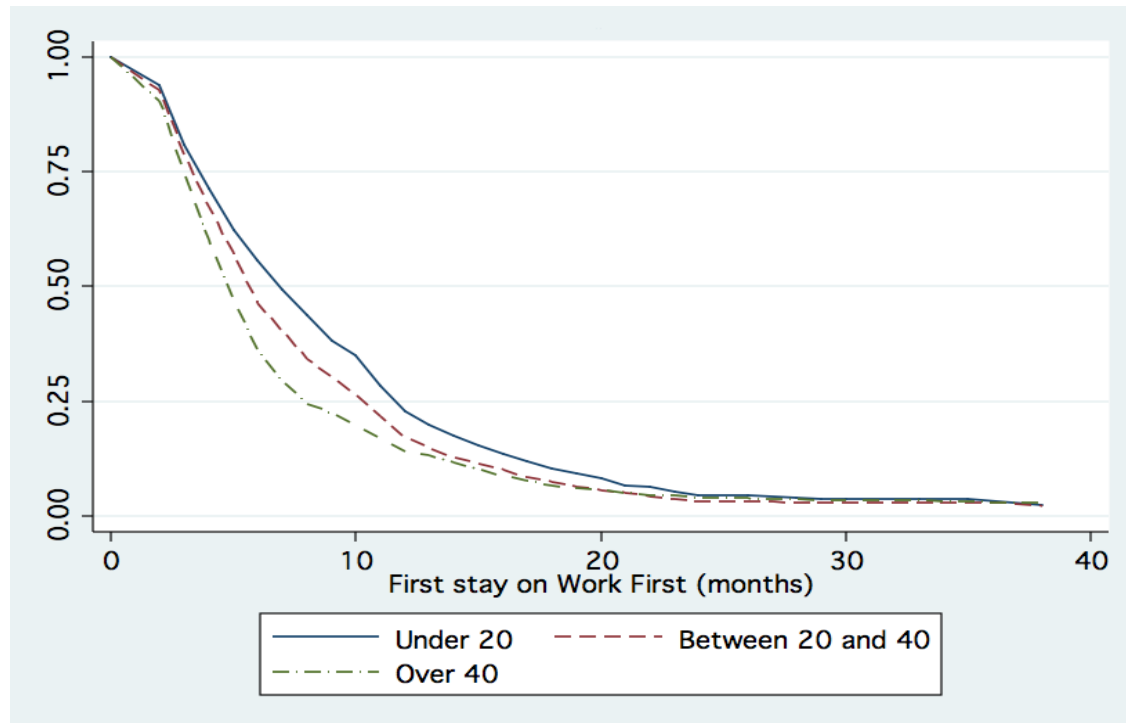
Descriptive statistics and preliminary analysis

The study subjects were single female Work First participants with dependent children less than 5 years old who opened their first formal case (e.g., no sanction or diversion case) in North Carolina from January 1st, 2008 to December, 31st, 2008. Table 1 shows the descriptive statistics of the sample. The frequencies and percentages of all variables were measured by two or three groups to calculate the median length of their stay calculated by the Kaplan-Meier method. The total number of the study sample was 4,365, who lived in 100 counties of North Carolina. The total number of census tracts where the study sample lived was 1,155 among 1564 census tracts in North Carolina.

The average age of the sample population was 26.43 years (SD: 7.58). When categorized into three groups, less than 20 years old, between 20 and 30, and over 30 years old, the majority of the sample (2,524, 57.82%) was over 20 years old and less than 30 years old. Six hundred and fifty participants (14.89%) were less than 20 years old and 1191 (27.29%) were more than 30 years old. The median length of stay was 7 months for the youngest group (less than 20), 6 months for the middle group (20-30) and 5 months for the oldest group (more than 30). The difference of median length of stay was statistically significant. The youngest group was likely to stay longer than other age groups, because they were likely to have younger children. The graph shows survival curves for length of stay by age groups.

Figure 2.

Survival Curves for First Stay on Work First by Age Group



The analysis indicated that 3,881 (88.91%) participants had one or two children under 5 years old, and their median length of stay was 6 months, whereas Work First participants who had more than two dependent children under 5 years old were 484 (11.09%) and their median length of the stay was 5 months. The difference was statistically significant.

The race/ethnic composition was 33.2% non-Hispanic White (1,450), 58.3% African American (2,545), and 8.5% other or multi racial/ethnic groups (n=370). The median lengths of the stay for three racial groups were all the same (6 months). However, the result from the life test analysis said that the differences between survival curves three groups were statistically significant. Although the median months of racial groups were the same, the length of stay for the 75th and 25th percentiles were different. For the 25th percentile of each group, non-Hispanic white Work First participants were expected to stay 3 months, African Americans were expected

to stay 4 months, and other racial groups were expected to stay 3 months. For the 75th percentile, non-Hispanic Whites were expected to stay 10 months, African Americans 11 months, and others 10 months. To identify which group difference was statistically significant, three separate life test analyses using the Kaiser Meier method with three dummy variables were run: white or African Americans, African American or other racial groups, and white or other racial groups. The results indicated that the differences between African Americans and white, and between African Americans and other racial groups were statistically significant, but the difference between white and other racial groups was not statistically significant.

Figure 3

Survival Curves for First Stay on Work First of African American Mothers and Other Racial Group Mothers

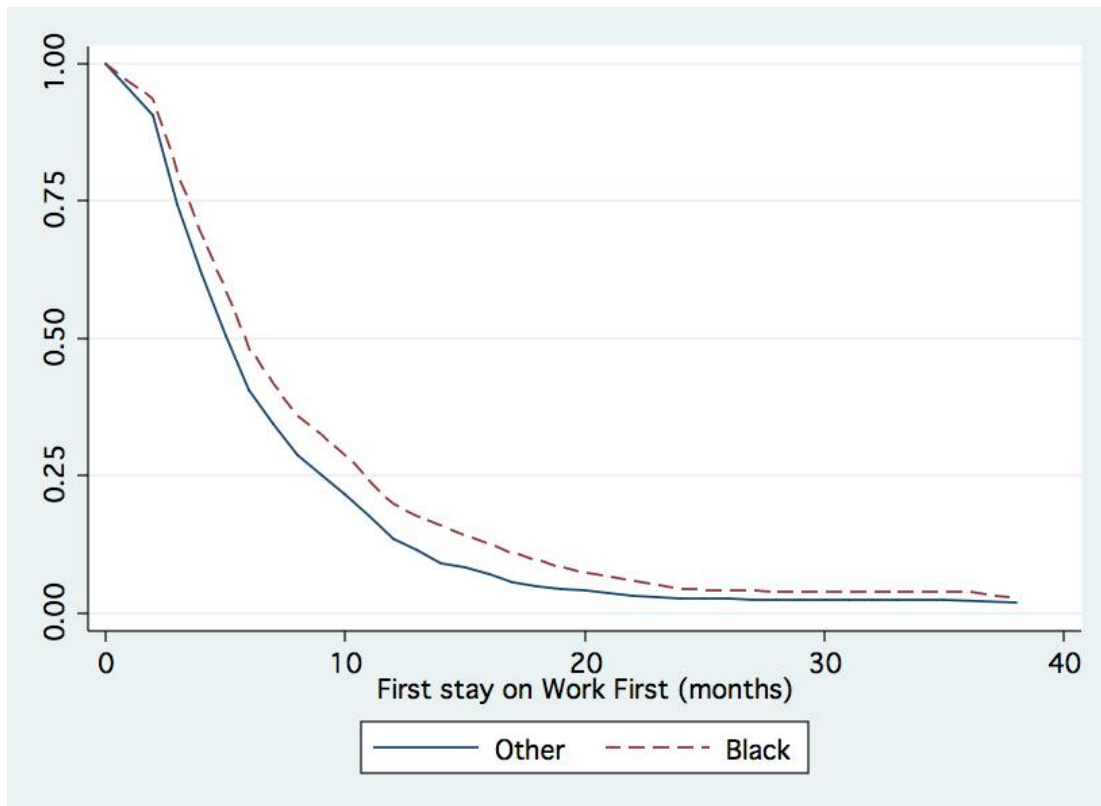


Figure 3 showed survival curves for length of stay by African American and other racial groups, including non-Hispanic white and other racial/ethnic groups. African American Work First participants were likely to stay longer than their counterparts from other racial groups.

For more than half of Work First participants (63.12%), the sum of five travel times to each closest high-quality subsidized child care center was less than 20 minutes. Seven hundred fifty-three participants had total travel time between 20 minutes and 40 minutes, and 857 participants had more than 40 minutes. The median lengths of stay for three groups of Work First participants based on total travel time to 5 closest child care facilities were all the same (6

months), and the difference was statistically significant. Again their median lengths of stay were the same but other percentiles' values were different.

The proximity to faith-based organizations showed patterns that were similar to child care facilities. Fifty-nine percent of the study sample had less than 20 minutes of total travel time to the 5 closest faith-based organizations. The analysis indicated that 23.67% of the study sample (1,033) had more than 40 minutes travel time. When the study sample was divided into three groups based on total travel time to the 5 closest faith-based organizations (e.g. less than 20 minutes, 20-40 minute, and more than 40 minutes) median lengths of stay on Work First for three groups were the same (6 months), but the difference was statistically significant.

Just less than 60% of study participants were located within 20 minutes of driving distance to the 5 closest faith-based organizations. Work First participants were more likely to live farther from charitable food services organizations than child care facilities and faith based organizations. This might be caused by the number of each organization in North Carolina. The number of subsidized quality child care facilities in this study was 4,834, and the number of faith-based organizations was 2,048. The number of charitable food services, such as food banks, food pantries, or soup kitchens, was 109.

Most Work First participants (78%) lived within 20 minutes of the county department of social services office, and 81% of them lived within 20 minutes of the county health department. However, due to the smaller number of state residential facilities (N=18), 78% of Work First participants had to drive more than 40 minutes to arrive at the closest residential facility. Among travel times to state/county social service agencies, the difference among groups by travel times to residential facilities was statistically significant.

Table 2

Descriptive Characteristics of Sample

Characteristics	Category	Frequency (%)	Median length of time
Age (in years)	Less than 20	650 (14.89)	7***
	20 - 30	2524 (57.82)	6***
	More than 30	1191 (27.29)	5***
# of dependent children	1-2	3881 (88.91)	6***
under 5 years old	2 more	484 (11.09)	5***
Months on Work First	Less than 6	1950 (44.67)	
	6 to 12	1479 (33.88)	
	12 to 24	754 (17.27)	
	More than 24	182 (4.17)	
Race/ethnicity	Caucasian	1450 (33.22)	6***
	African Americans	2545 (58.30)	6***
	Others	370 (8.48)	6***
Travel minutes	Less than	2755 (63.12)	6**

	20		
to 5 closest child care facilities	20-40	753 (17.25)	6**
	More than 40	857 (19.63)	6**
Travel minutes	Less than 20	2581 (59.13)	6**
to 5 closest churches	20-40	751 (17.21)	6**
	More than 40	1033 (23.67)	6**
Travel minutes	Less than 20	29 (0.66)	7
to 5 closest food banks	20-40	213 (4.88)	6
	More than 40	4123 (94.46)	6
Travel minutes	Less than 20	3427 (78.51)	6
to county department of social services	20-40	887 (20.32)	6
	More than 40	51 (1.17)	5
Travel time	Less than 20	3521 (80.66)	6

to county health department	20-40	837 (19.18)	6
	More than 40	7 (0.16)	5
Travel minutes	Less than 20	549 (12.58)	5***
to closest county residential facility	20-40	369 (8.45)	6***
	More than 40	3447 (78.97)	6***

* total does not add up to 100 due to rounding.

Table 3

Characteristics of Neighborhood Where Work First Participants Lived

Characteristics	Mean	(SD)	NC	NC
-----------------	------	------	----	----

			Mean	Median
# of census tracts	1155			1563
% of household's income with less than \$20,000	28.50%	0.1291	26.83%	24.77%
% of household's income with less than \$50,000	31.18%	0.1324	29.82%	32.16%
% of African Americans	35.27%	0.2657	28.43%	16.29%
% who have lived in same county since 1995	24.95%	0.0668	24.78%	22.62%

Work First participants were likely to live in disadvantaged neighborhoods. The median percentage of households with income less than \$20,000 among census tracts was 26.8% (North Carolina median, 24.77%), but the median percentage of household income with more than \$50,000 was 29.82% (North Carolina median, 32.16%). The median percentage of African Americans was 28.43% (North Carolina median, 16.29%). The median percentage of households living in the same county since 1995 was 24.78%, which was higher than the North Carolina median of 22.62%.

Figure 4 shows the residential locations of Work First participants with the total population in each census tract. The residential locations are mainly located in high population density areas. Figure 5 shows child care facilities' locations on the percentage of people under 5 years old. The value of global Moran's I of Child care location distribution was 0.09 (z-value: 18.08), while of Work First participants was 0.18 (z-value: 35.56).

Figure 4

Residential Location of Work First Participants

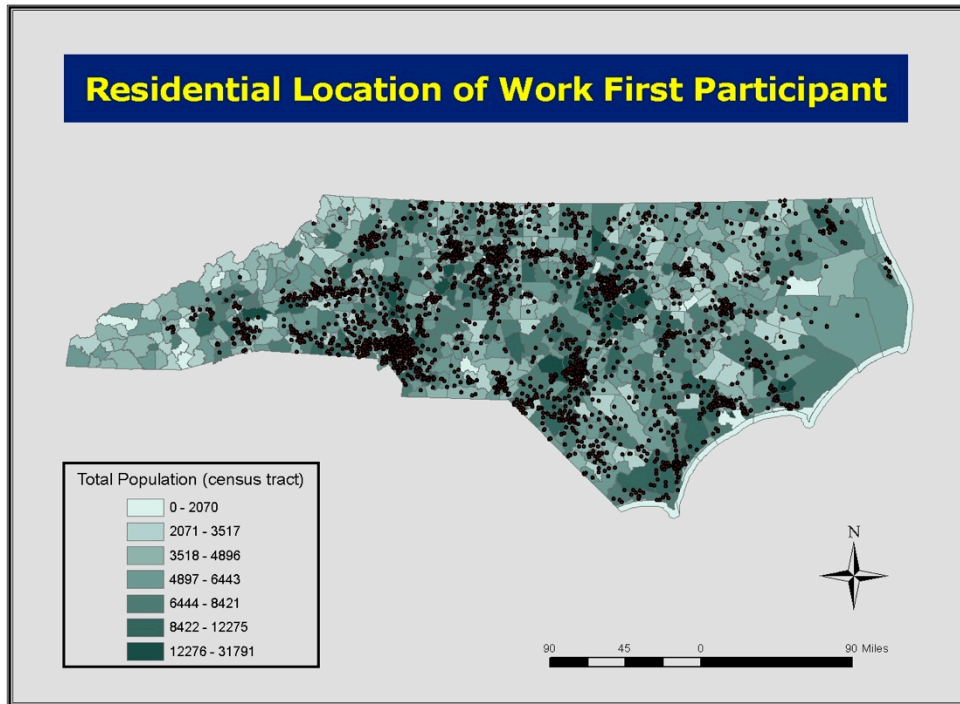
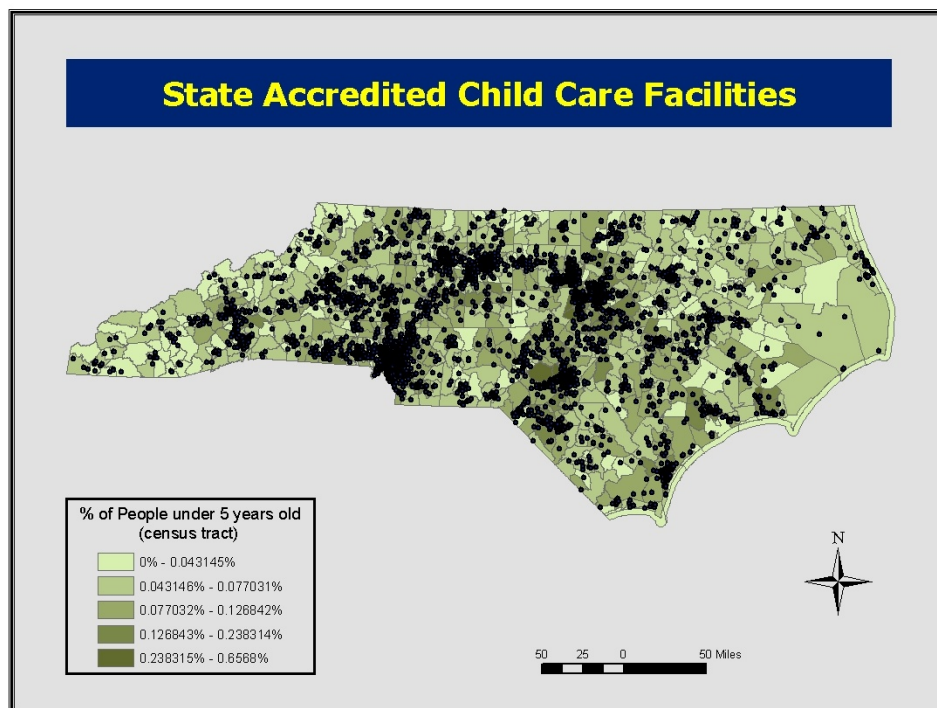


Figure 5

State-accredited Child Care Facilities in North Carolina



Proximity to child care and social services

To examine the proximity of Work First participants to child care facilities that offered high quality services, county social service offices, and non-profit social services agencies, descriptive statistics and Moran's I of GIS tools were used. The average travel time to the closest child care facility was 2.98 minutes (SD: 3.7596. Range: 0 to 33.89 minutes). Work First participants who had 0 minutes of travel time to the closest child care facility were seven. After a close review of their street addresses and the addresses of their closest child care facilities, it was verified that all of them lived next to child care facilities. The average travel time to the 5 closest child care facilities was less than 5 minutes (4.89, SD: 5.0355). The average distance to the closest child care facility was 1.51 miles (SD: 1.9764. range 0 to 19.92 miles). The average

distance from the 5 closest child care facilities was 2.62 (SD: 2.8272). The average stars those child care facilities received from the State were less than 4 (2.93). Work First participants who lived in rural and/or coastal areas showed a longer travel time to a child care facility than those who lived in urban and suburban areas.

The average travel time to the closest faith-based organization was 3.2452 minutes (SD: 3.9204, range 0 to 63.18). There were six Work First participants who had no travel time to the closest faith-based organizations. Like child care facilities, these 6 participants lived next to faith-based organizations. The average distance to the 5 closest faith-based organizations was 2.9879 miles (SD: 3.2085). The average travel time to the closest food service agency was 19.2212 minutes (SD: 16.5705, range 0.0328 to 94.3320). The average distance to the closest food service agency was 12.2991 miles (SD: 11.2698, range 0.01137 to 70.36612). The average time to the 5 closest food service agencies was 35.4323 minutes (SD: 23.3820, range 2.9090 to 129.1185). The average distance to the 5 closest food service agencies 24.7843 miles (SD: 17.3233, range 1.4988 to 100.6033).

Moreover, the average travel time to the county Department of Social Services was 13.5577 minutes (SD 10.9777, 0.0002 to 326.0513). The average travel time to the county department of social services was 8.4823 miles (SD: 7.9631, range 0 to 284.4228). The average travel time to the county health department was 12.6942 minutes (SD: 7.9707, 0.0211 to 45.7542). The average distance to the county health department was 7.9443 miles (SD: 5.2601, 0 to 27.4001). The average time to the closest residential facility was 78.3822 minutes (SD: 49.2756, 0.2227 to 383.1897). The average distance to the closest residential facility was 63.6688 miles (SD: 42.4026 0 to 317.8947).

Next, Moran's I was used to assess the spatial autocorrelation among neighborhoods regarding the distribution of high quality subsidized child care facilities, faith-based organizations, and charitable food service agencies. First, global Moran's I was calculated for each distribution of child care facilities and social services to see if there were spatial autocorrelations among all of North Carolina. Global Moran's I value of the distribution of child care facilities in North Carolina was 0.09 (z-score: 18.08). There was less than a 1% likelihood that this clustered pattern could be the result of random change. Global Moran's I value of the distribution of faith-based organizations was 0.05 (z-score: 9.16) There was less than a 1% likelihood that this clustered patterned could be the result of random change. Global Moran's I value of the distribution of food banks in North Carolina was 0.01 (z score: 2.12). There was less than a 5% likelihood that this clustered pattern was the result of random chance.

Not surprisingly, Global Moran's I showed that there were statistically significant autocorrelations among child care facilities, faith-based organizations, and food banks at the census tracts in North Carolina. This was expected because the social service and child care facilities were built by human-beings, so they were built to avoid geographical barriers, such as mountains, rivers, and so on.

Local Moran's I provided more interesting insight about the proximity to social services and child care facilities. Local Moran's I allowed census tracts neighboring census tracts having similar or different characteristics to be identified. Local Moran's I tool in ArcGIS generated three numbers and one indicator, local Moran's I index, local Moran's I Z score, and local Moran's I p value, and the cluster type indicator for each spatial unit. Moran's I Z score and p value indicates the statistical significance of Moran's I index. The cluster type indicator has four types, such as HH, LL, HL, and LH. HH means that a census tract has a high frequency of child

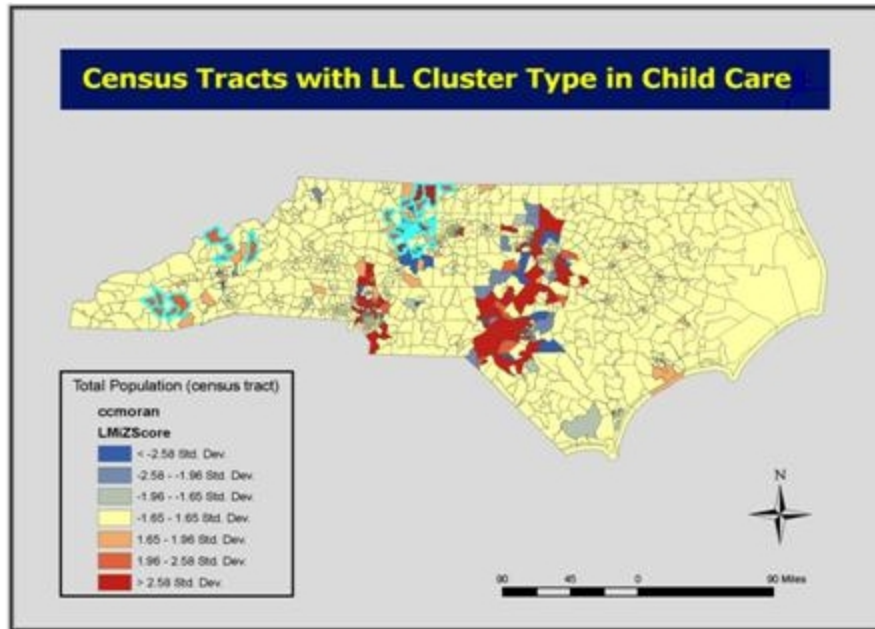
care facilities or social service agencies and is surrounded by census tracts having high frequencies. LL means that a census tract has low frequency, and its surrounding census tracts also have low frequencies. LH means a census tract has a low frequency of child care centers or social service agencies, but its surrounding census tracts have high frequencies. HL means that a census tract has high frequency but its surrounding areas has low frequencies. The cluster type indicator is provided only when Moran's I index is statistically significant.

A high positive Z score means that its surrounding census tracts have similar characteristics. A high positive Z score comes with HH or LL cluster type when it is statistically significant. A low negative value of Z score, such as less than indicates that its surrounding census tracts have different characteristics. In this case, cluster type values would be LH or HL when it is statistically significant.

Among a total of 1,155 census tracts which didn't have child care facilities that accept child care vouchers and are highly rated by the state, 266 census tracts have Work First participants' households. We can imagine if a mother lives in the neighborhood having no child care facilities, she would look for child care center facilities in adjacent neighborhoods. However, if surrounding neighborhoods also have none or a limited number of subsidized quality child care facilities, it could be a major barrier to access.

Figure 6

Census Tracts with LL Cluster Type in Child Care Facilities



Forty-seven census tracts were identified as LL cluster type. This suggests that residents in those census tracts faced more serious difficulty in physical accessibility. Work First participants in those areas suffered from a lack of high quality child care facilities that accepted child care subsidy vouchers in their own neighborhood as well as from a lack of child care facilities facilities in surrounding areas. In Figure 6, the census tracts with LL cluster types were highlighted by a light blue color. Most of the LL cluster types were concentrated in mountain areas.

Figure 7

Census Tracts with LL Type of Faith-Based Organizations

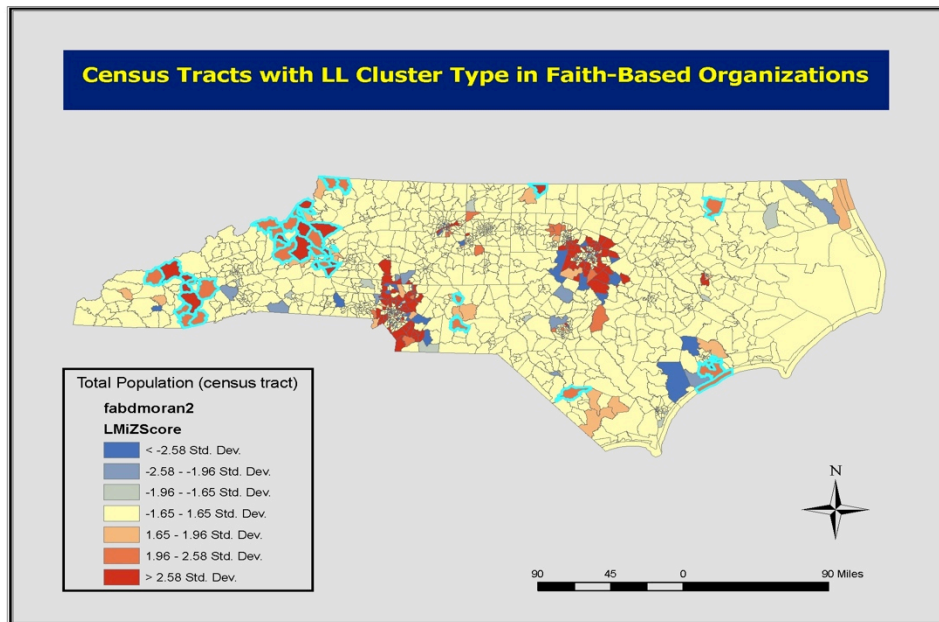


Figure 7 showed the distribution of census tracts with the LL cluster type of faith-based organizations. Forty-eight census tracts had LL cluster types, which suggests that the Work First participants in these neighborhoods faced double the difficulties in finding faith-based organizations in their own neighborhood as well as in neighboring census tracts. Two census tracts in the east-south part of North Carolina were LL cluster types both in the distribution of child care facilities and faith-based organizations. The results of Local Moran's I analysis on food banks and county social service agencies showed there was no LL cluster types in North Carolina.

Multi-level Analysis for Exit from Work First

Before the running LWA corrective cox regression, two diagnostic tests (Allison, 1995; Guo, 2010) were run to identify the extent of the autocorrelation among Work First participants because study subjects were nested in a census tract. From one-way ANOVA with random effect, IntraClass Correlation (ICC) was 6%, which suggests that 6% of the total variance of Work First stays were due to the census tract group. ICC was small, but multilevel analysis is still recommended when ICC is as low as .02 (Kreft & de Leeuw, 1998).

The second test also followed Allison (1995) and Guo (2010). First, I selected instances where more than one Work First participants lived in census tract. Among the 1,155 census tracts, 853 contained more than one participant and a total of 4,063 participants lived in 853 census tracts. These 853 census tracts were selected for the analysis. One participant was randomly selected from each census tract. The months on Work First of participants who were omitted from the analysis were used as one of the predictors of exit from Work First. An uncorrected Cox model with 3,210 participants was run. The coefficient of length of stay among an omitted participant was -0.00776 ($p < .002$) and the hazard ratio was 0.992. If the length of stay of the omitted participant was predictive of the length of the stay of the rest of participants who lived in the same census tract of the omitted participant, the data has a group heterogeneity problem (Guo, 2010). It means the data should be analyzed with methods that are capable of the autocorrelation of the data.

A total of 4,365 Work First participants were used to evaluate the time to exit from Work First. In this analysis, 4,206 participants achieved their exit from Work First within the two-year study window, and 159 participants were censored. Two LWA corrective Cox models were executed to evaluate the main effects and interactions. Table 4 shows the result from the main effect model. Age, being African Americans, having more than 2 children under 5 years old,

travel time to the 5 closest charitable food services, and travel time to state residential facilities were statistically significant among individual level predictors. The participant's age was highly significant ($p<.0001$) and its hazard ratio was 1.0093. The analysis suggests that for each year of increase in age, a participant's likelihood of leaving Work First increased by 0.93%. Also being African American was significant ($p<0.01$) and its hazard ratio was 0.8913. This indicated that African Americans exited from Work First 10.87% slower than other racial/ethnic groups. Having more than 2 children under 5 years old was also significant ($p<0.01$) with a hazard ratio of 1.1588. It suggests that a participant who had more than two children under 5 years old exited from Work First 15.88% faster than a participant who had one or two children under 5 years old.

Travel time to the 5 closest charitable food services was significant ($p<0.05$) with a hazard ratio of 1.0004. This means that for each one minute increase in the travel time to 5 closest charitable food service agencies, a participant exited from Work First 0.04% faster. Travel time to state residential facilities was highly significant ($p<0.001$) with a hazard ratio of 0.9982. This means that for each one minute increase in the travel time to residential facilities managed by North Carolina state, a participant achieved exit from Work First 0.18% slower.

Two neighborhood characteristics were related to speed of exit from Work First. The percentage of African Americans in the neighborhood and the percentage of living in same county since 1995 in the neighborhood were statistically significant among neighborhood level variables. The percentage of African Americans in the neighborhood was statistically significant ($p<0.01$) with a hazard ratio of 0.7442. This suggests that for each 1 percent increase in African Americans in the neighborhood, a Work First participant achieved exit 25.58% slower. The percentage of residences in the same county since 1995 was significant ($p<0.01$) with a hazard

ratio of 0.5713. This indicated that for each one unit increase in the percentage of residences in same county since 1995, a participant exited from Work First 42.87% slower.

Table 4

LWA Corrective Cox Model with Main Effects

Variables	Description	Coef		Hazard Ratio
Individual level				
Age	Age	0.0093	***	1.0093
Black (dummy)	African Americans (1)	-0.1151	**	0.8913
Kid2 (dummy)	Having more than two children (1)	0.1473	**	1.1588
Tottime	Total travel time to 5 closest child care facilities	-0.001		1.0010
chtottime	Total travel time to 5 closest faith-based organization (church, temple etc)	0.0007		1.0008
fdtottime	Total travel time to 5 closest food banks, soup kitchens, or food pantries	0.0004	*	1.0004
dsstime	Travel time to county department of social services	-0.0042	p=0.06	0.9959
hdtime1	Travel time to county health department	-0.0019		0.9981
rftime1	Travel time to state residential facilities ADATC, developmental center, neuro-medical center, regional hospital,	-0.0019	***	0.9982

	school for people with hearing and vision disabilities			
Neighborhood Level				
pctl20k	% of household income less than \$20,000	0.2383		1.1291
Pctbl	% of African Americans	-0.2954	**	0.7442
pctm50k	% of household income more than \$50,000	0.0394		1.0401
Pctrmo_c	% of live in same county since 1995	-0.5599	**	0.5713

*** p<0.001, ** p<0.01, * p<0.05

After testing main effects, additional analysis was undertaken to test for potentially significant interactions. This study employed both theory and data driven approaches to assess interactions. Eleven interactions were identified to be statistically significant when individually tested. Four cross-level interactions were statistically significant. Interactions between the percentage of residences in the same county since 1995 and travel time to the 5 closest faith-based organizations, the percentage of residences in the same county since 1995 and travel time to the 5 closest charitable food service agencies, the percentage of African Americans in the neighborhood and travel time to the 5 closest charitable food service agencies, and the percentage of African Americans and the percentage of household incomes more than \$50,000, were significant. Seven interactions among individual characteristics were significant. Interactions of the percentage of African Americans and total travel time to the 5 closest child

care facilities, and the percentage of African Americans and travel time to the county Division of Social Services were significant. Interactions of having more than two children under 5 years and each travel time to the 5 closest child care facilities, the 5 closest faith-based organizations, the 5 closest charitable food service agencies, travel time to the county Division of Social Services, and travel time to the county health department were significant.

When all these interactions were entered together, two interaction terms, the percentage of African American and total travel time to the 5 closest child care facilities, the percentage of African Americans and percentage of household income more than \$50,000 were statistically significant. All individual level variables, except total travel time to the 5 closest charitable food service agencies, were significant. Two neighborhood variables, the percentage of African American in the neighborhood and the percentage of residences in the same county since 1995, were significant.

As shown in Table 5, participants' age was significant ($p < 0.001$) with a hazard ratio of 1.0092. This meant that for each one year increase in the age of a participant, she exited from Work First 0.92% faster. African American participants exited from Work First 10.79% slower than participants from other racial ethnic groups ($p < 0.01$). Work First participants who had more than two children under 5 years old achieved exit from Work First quicker than women with one or two children under 5 years old. Travel time to residential facilities managed by North Carolina state was also statistically significant ($p < 0.001$) with a hazard ratio 0.9982. This indicated that for each additional one minute increase in travel time to a state-managed residential facility, a participant achieved exit from Work First 0.18% slower.

The percentage of African Americans in the neighborhood was significant ($p < 0.01$) with a hazard ratio of 0.7360. This indicated that for each additional one percent increase in the

percentage of African Americans in the neighborhood, a participant exited from Work First 30.66% slower. Also the percentage of residences in the same county since 1995 was significant ($p<0.01$) with a hazard ratio of 0.5820. This meant that for each one percent increase in the percentage of residences in the same county since 1995, a participant achieved exit from Work First 54.13% slower.

Table 5.

WLA Corrective Cox Models with Main Effects and Interaction Terms

Variables	Description	Coef		Hazard Ratio
Individual level				
Age	Age	0.0091	***	1.0092
Black (dummy)	African Americans (1)	-0.1079	**	0.8977
Kid2 (dummy)	Having more than two children (1)	0.1430	**	1.1537
Totttime	Total travel time to 5 closest child care facilities	-0.0005		0.9995
Chtotttime	Total travel time to 5 closest faith-based organization (church, temple etc)	0.0005		1.0005
Fdtotttime	Total travel time to 5 closest food banks, soup kitchens, or food pantries	0.0004	$p=0.06$	1.0004
Dsstime	Travel time to county department of social services	-0.0041	$p=0.06$	0.9959
hdtime1	Travel time to county health	-0.0016		0.9984

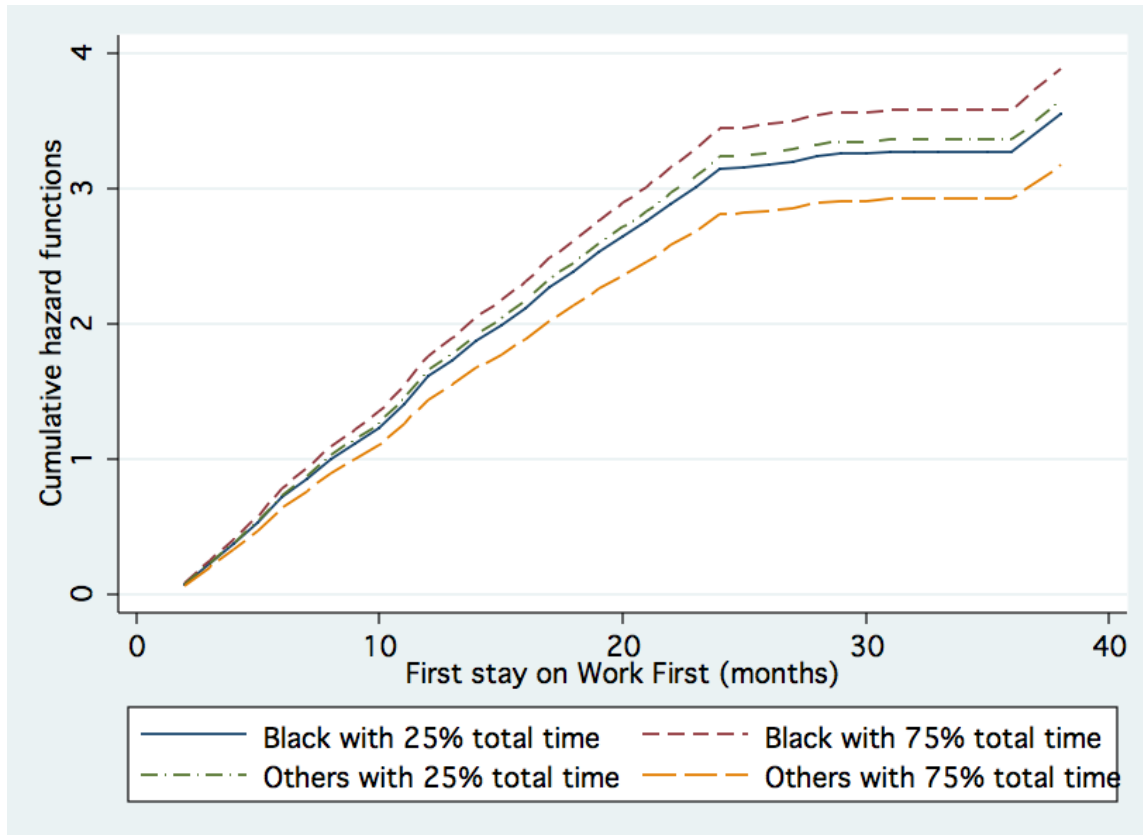
	department			
rftime1	Travel time to state residential facilities ADATC, developmental center, neuro-medical center, regional hospital, school for people with hearing and vision disabilities	-0.0019	***	0.9982
Neighborhood Level				
pctl20k	% of household income less than \$20,000	0.1198		1.1272
Pctbl	% of African Americans	-0.3066	**	0.7360
pctm50k	% of household income more than \$50,000	0.3106		1.3643
Pctrmo_c	% of live in same county since 1995	-0.5413	**	0.5820
Interaction				
black*tottime	African Americans*total travel time to 5 closest child care facilities	0.0030	*	1.0031
black*pctm50k	African Americans*% of household income more than \$50,000	-0.6029	*	0.5472
kid2*tottime	More than 2 kids*total travel time to 5 closest child care facilities	0.0027	0.09	1.0027

*** p<0.001, ** p<0.01, * p<0.05

The interaction of African Americans and total travel time to the 5 closest child care facilities was significant ($p < .05$) with a hazard ratio of 1.0031. This meant that travel time to the 5 closest child care facilities affected the relationship between African American and speed of exit from Work First. The meaning of interaction was graphically presented in Figure 8. The figure illustrates the travel time for African American women and those from other racial and ethnic groups to the five closest child care centers. The travel times are presented for the 75th percentile and 25th percentile of each group.. Interestingly, the effect of total travel time to the 5 closest child care facilities on speed of exit was varied by women's race/ethnicity. For the other race/ethnicity group, women who had a lower level of proximity to high quality child care facilities that accepted child care subsidy vouchers exited from Work First slower than their counterpart who had a higher level of proximity. However, for African Americans, women who were further away from child care facilities achieved a quicker exit from Work First than their counterparts who were closer to child care centers.

Figure 8

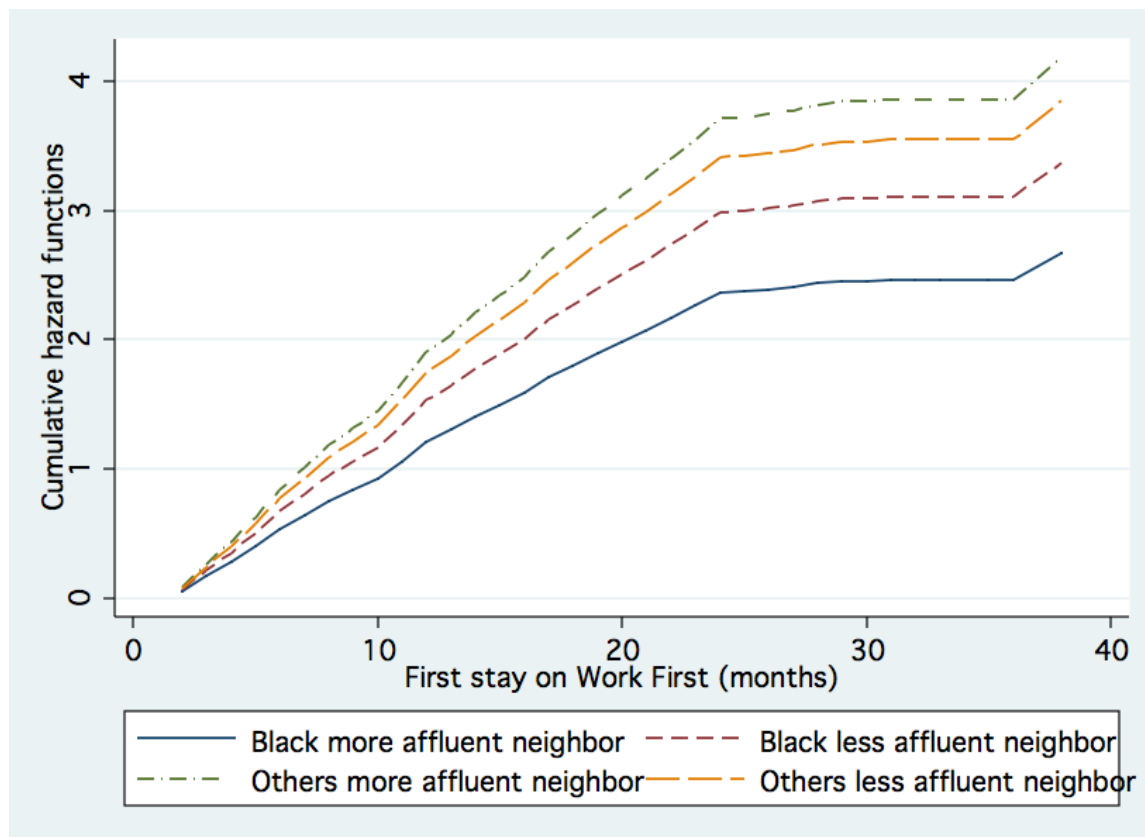
The Interaction of African American and Total Travel Time to the 5 Closest Child Care Facilities



Another significant interaction term was the interaction of African American race and neighborhood affluence, defined as the percentage of households with incomes greater than \$50,000. Figure 9 illustrates that relationship. Female Work First participants who are not African Americans, participants who lived in affluent neighborhoods showed a quicker welfare exit than women who lived in less affluent neighborhoods. African American participants who lived in affluent neighborhoods exited Work First more slowly than all other women. The time to welfare exit among African American women who lived in affluent neighborhoods was longest.

Figure 9

Interaction of African American and the Percentage of Households with Income > \$50,000



Three additional analyses were conducted to assess the effect of 705 missing cases. First, Table 6 reports the results of tests to detect if there is significant difference in demographic characteristics, such as age, number of dependent children under 5 years-old and dependent variable (e.g. first stay on Work First), between the geocoded group and those who were not geocoded. As the table reports, there was no statistically significant difference in Work First participants' age, number of children under 5 years-old, and the length of first stay on Work First between the two groups.

Then LWA corrective Cox model with main effect and LWA corrective Cox model with interaction terms were executed. This additional analysis results were presented in the Appendix. There was no significant difference between two analyses.

Table 6

Mean Difference between Geocoded vs Un-geocoded Cases

Variable	N	Mean	SD	t	P value
fstay5	486	8.0288	6.5939	-0.71	0.4759
	4360	8.2592	6.7739		
Age	486	26.984	7.6719	1.54	0.1238
	4360	26.425	7.5816		
Nunder5	486	1.5309	0.8676	1.40	0.1625
		1.4759	0.8173		

DISCUSSION AND IMPLICATIONS

This study investigated how the geographic proximity of a high-quality child care facility and social service agency affect length of stay in Work First among a sample of single mothers with dependent children. This sample included women who enrolled in Work First for the first time between January and December 2008. It also explored whether geographic proximity of child care facilities and social services affected the effect of neighborhood characteristics on length of stay in Work First.

Reliable and affordable child care and supportive social services are essential for children's healthy development and for promoting employment among TANF recipients (Allard, 2009; Allard et al., 2003; Anderson et al., 2004; Cheng, 2009; Fuller et al., 2007). Given states' flexibility in allocating block grant funding in the wake of Welfare Reform, there has been an effort to make licensed child care more affordable for TANF recipients (Hirshbberge & Fuller, in press; Perlmutter & Bartle, 2003; Robins, 2007; Zaslow et al., 1998). Despite these efforts, few researchers have examined the accessibility of child care for individual TANF participants with dependent children. In addition, social services have become a more critical element of support for people in need after welfare reform. Empirical research suggested that the proximity of the person in need of the service to the provider of social services is a critical service delivery factor (Allard, 2009; Allard et al., 2003, Joassart-Marcelli & Wolch, 2008; peck, 2008).

This study employed Geographic Information Systems (GIS) technology to calculate the summed travel time from Work First participants' homes to the five closest child care facilities

that accept child care subsidies and are accredited by the state of North Carolina, and county social services and social services offered by non-profit organizations, such as faith-based organizations and charitable food services. This technology illustrates the geographic distribution of accredited child care facilities that accept child care subsidies and the distribution of social services and compared them to the geographic distribution of Work First participants' homes.

This study examined whether excluding cases with missing street address affected the analysis (e.g. cases that could not be geocoded). The study used a t-test to detect significant differences in age, number of dependent children under 5 years old, and length on Work First, between the two groups that were and were not geocoded. The results indicated that these missing data were not informative; there were no differences in length of stay on Work First among women who were and were not geo-coded.

Review of Findings

This study analyzed the relationship between resource availability and length of time on Work First for 4,365 single mothers with dependent children less than 5 years old who opened their first formal welfare case in 2008. More than 75% of the study subjects were older than 20 years old and 89% of them had 1 or 2 dependent children under 5 years old. Slightly fewer than 80% of them exited from Work First within one year and only 4.2% of them stayed on Work First for more than 2 years. Fifty-eight percent of mothers in the sample were African American and 33% were non-Hispanic White.

The study revealed that younger mothers were likely to stay longer than older mothers. Also the median length of stay among participants who had more than two children was shorter

than those who had one or two children. The length of stay was also varied by race. African American mothers were likely to stay longer than mothers from other racial/ethnic group.

The findings of this study suggest that the younger single mothers were likely to remain significantly longer on Work First than the older groups. Variation in the length of stay on welfare may be caused by several reasons. Past studies have found that mothers' ages were related to the ages of dependent children at least in part because older children age out from welfare (Blank & Ruggles, 1994). Also given that this study counted only first entrance to Work First, the opening of a woman's first welfare case earlier in her life may imply a lack of financial and social resource from their family of origin and significant interruption to their secondary and/or post-secondary education. These factors may in turn be associated with diminished social and human capital, which make it harder for women to secure employment.

In addition, the median length of stay among Work First participants who had more than two dependent children was shorter than those who had one or two children. The shorter stay of mothers with more children may be related to the mother's age. The analysis showed the mean age of participants who had more than two children was 30.37 years old, whereas the mean of women with one or two children was 25.93. Also many single low-income mothers rely on older children to provide care to younger children (Bianchi, 2011). According to Bianchi (2011), sibling care often helps low-income single mothers to balance work and family, however, it may cause a negative effect on the school attendance and academic performance of older children.

The length of stay was also varied by race and ethnicity. There was no different in the median lengths of stay among White, African American, and other racial classification. However, the 75th percentile lengths of stay were significantly different. The 75th percentile length of stay was 11 months for African American women and 10 months for White women and

for women from other racial or ethnic groups. This means that there was no ethnic/racial difference among mothers who exited Work First within the 25% of women who were earliest-leaving. However, there was a statistically significant difference among participants in the cohort of 75% who stayed the longest on Work First. So the Work First spell of African American mothers who exited within the 75% of women who stayed the longest on Work First was one month longer than her counterparts from other racial/ethnic groups, on average. Since a longer stay on welfare implies greater difficulty achieving economic self-sufficiency, single low-income African American mothers are more vulnerable than their counterparts from other racial/ethnic groups.

This study also examined the physical accessibility of county social service offices, nonprofit food service organization, faith-based organizations, and child care facilities that accept Work First vouchers in North Carolina. The GIS analyses found that most Work First participants had quality child care facilities and faith-based organizations within a relatively short distance from their homes. The average distance to closest child care facility was 1.51 miles and the average distance to closest faith-based organization was 2.99 miles. However, some participants had to drive more than 30 minutes to arrive at any of the five closest child care facilities that both accepted the state's child care subsidies and provided relatively reliable and affordable care. Moreover, the GIS findings indicated that, for 47 census tracts (4.08%) among 1151 census tracts, there was lack of quality child care facilities that accepted child care vouchers in their own census tracts and also in neighboring census tracts. Work First participants in 48 census tracts (4.17%) among 1151 census tracts faced difficulties finding faith-based organizations in their own census tracts as well as in neighboring census tracts.

The implications of these findings are important, because the limited availability of reliable child care facilities likely limits mothers' ability and/or willingness to find work that will allow them to leave Work First and become financially self-sufficient. Empirical studies have identified that low-income working mothers consider the trip to the child care center as part of their work-related commute (Gilbert, 1998). Further studies have found that women prefer shorter commutes than their male counterparts in order to be closer to their children. This "geographical boundedness" constrains low-income women's job searching and work performance (Gilbert, 1998). These previous findings underscore the impact of the proximity to child care on working mothers. For Work First mothers, who are particularly vulnerable, this issue of geographic proximity is likely to be critically important.

The study also investigated the influence of neighborhood characteristics on the length of stay in Work First. After controlling for individual characteristics greater length of stay on Work First was found for mothers who lived in neighborhoods (1) with a greater proportion of African Americans, (2) with little mobility or turnover since 1995. Additional analyses indicated neighborhoods with a higher percentage of African American residents also had the highest proportion of low-income households. This analysis suggested possible racial and income disparities among neighborhoods. These disparities may hinder the most vulnerable residents, including women who are Work First recipients, from gaining economic self-sufficiency.

Also the result showed that two interaction terms, interaction between mothers' race and the proximity to high quality child care facilities and mothers' race and the percentage of low-income household in neighborhood, were statistically significant. The study confirmed that the effects of certain neighborhood characteristics and resource proximity played different role by individual's race/ethnicity by showing the significance of interaction terms. First, the effect of

proximity to high quality child care facilities was different by Work First mothers' race. From the Kaplan-Meier tables, the group with longer travel time to the 5 closest child care facilities had a longer stay on Work First. However, according to the interaction of the LWA corrective Cox proportional hazard model, the effect of proximity to child care facilities varied by race. Whereas Work First mothers from the other race and ethnic group who had better proximity to child care facilities showed a quicker exit from Work First, African American Work First mothers who had better proximity showed slower exit. This result may be related to different patterns of child care utilization by race/ethnicity. While earlier studies found that African American mothers were more likely to rely on instrumental child care support from their family and kinship networks, more recent empirical studies revealed that low-income African American mothers were more likely to use child care subsidies when subsidy programs were available (Shlay, et. al., 2010). However, few empirical studies have comprehensively examined low-income mothers' child care subsidy utilization.

A significant interaction was found between neighborhood affluence, race, and length of stay on Work First (Figure 9). For White women and women from other racial/ethnic groups, living in a more affluent neighborhood was associated with exiting Work First in a shorter time. However, African American mothers who lived in more affluent neighborhoods exited Work First more slowly than African American mothers who lived in less affluent neighborhoods. African American mothers who lived in more affluent neighborhoods also exited Work First more slowly than other women who lived in less affluent neighborhoods.

A decade ago, the Department of Housing and Urban Development (HUD) launched the Moving to Opportunity for Fair Housing Demonstration (MTO) in Baltimore, Boston, Chicago, Los Angeles, and New York. The MTO provided low-income families rental assistance vouchers

to make them relocate from higher poverty-concentrated neighborhoods to moderate or lower poverty-concentrated areas. More than four thousands families participated in the project from 1994 to 1998. This large-scale, experimentally designed project has attracted scholarly and publicly attention.

However, the final evaluation with long-term data shows that MTO had no detectable impact on earning and other labor market- related outcome or adolescents' academic achievement, while it improved outcomes for several measures of physical and mental health among youths (Gennetian et. al., 2012). One of the biggest criticisms toward the MTO demonstration project was that the MTO ignored the effect of racial composition; unlike the Gautreaux project, which encouraged participants to move into less minority-dominated neighborhoods in Chicago, the MTO only imposed poverty-rate restrictions on its participants (Clampet-Ludquist & Massey, 2008). More than 75% of the neighborhoods where the MTO experiment group relocated were minority-dominant neighborhoods, although the poverty rate of those neighborhoods was below 10%. The finding of this study might provide a possible explanation why MTO had no effect on earning and other economic performance outcomes among adult participants.

According to the study outcome, affluent neighborhoods had a positive effect on the speed of exit from Work First among non-Hispanic white and other race/ethnic group low-income mothers, but had a negative effect on the group of African American low-income mothers. The study result and MTO outcome won't be enough from which to draw the conclusion that the neighborhood's affluence doesn't affect economic performance of its residents nor that African American low-income mothers are worse off in low- or less- poverty concentrated neighborhoods. Rather, the study result calls for more scrutinized research on

different aspects of neighborhood attributes on its residents' well-being in the context of social and cultural diversity.

This study also found that there were many neighborhoods where Work First participants lived that contained no state-accredited child care facilities that accepted child care vouchers, and no non-profit social services. Many of these neighborhoods that lacked child care contained a higher than average percentage of households with income under \$20,000. More than 40% of Work First mothers whose neighborhood contained no accessible child care facilities lived in neighborhoods where 42% of households make less than \$20,000 a year. This lack of the proximity to child care may be one reason why the mothers in my study who lived in poorer neighborhoods took longer to exit from Work First than did the mothers living in wealthier neighborhoods.

Limitations

The data that this study relied on were large administrative data. Administrative data is not designed for research purposes. Some information that might be critical to understand the exit from Work First among study subjects could be collected, such as reason for exit, previous work history, health status of study participants and their children, and educational achievement.

This study couldn't include participants' current child care provider and the receipt of child care subsidy. The effect of the accessibility of child care facilities is highly likely to vary

depending on the exit type. As previous studies have revealed, many low-income single mothers rely on informal support from extended family members or close friends. However, this study does not examine informal support because the administrative data contained no variable indicating the type or amount of informal support that participants may have received. Future research may try to gather more information about subsidized child care facilities to answer the following questions. Does a child care center provide flexible service hours?

The information on non-profit social services was also limited to the existence of the services. However, for example, some charitable food services run meal delivery services to people who don't have mobility or people with disabilities. The size of each service and service hours could vary significantly.

Faith-based organizations provide a very different kind and level of social services. Some churches focus more on charitable activities or volunteer services. More comprehensive and detailed information is needed for future research.

Finally, this study dealt with the information from one state. Therefore the findings were only applicable to North Carolina and cannot be generalized.

Implications of the study

The study findings provided several implications for practice and policy around the economic self-sufficiency of single mothers in poverty. The study findings are also highly relevant to research and methods about neighborhood effects and the use of administrative data. Knowing that specific individual and neighborhood characteristics were related to the length of stay on Work First can inform policymakers and practitioners about the role of proximity to social resources. If policymakers and practitioners want to effectively promote a shorter stay on

Work First and ultimately improve the economic independence of Work First participants, it is crucial that they consider not just women's individual human and social capital, but also the characteristics of the neighborhoods in which the women live. Moreover, the effects of the same neighborhood characteristics differ depending on participants' race.

The finding of statistically significant interactions between race and neighborhood affluence as well as race and resource availability in this study reaffirmed the importance of racism and race-related discrimination in our society, and particularly with regard to the well-being of low-income African American mothers. It was striking that African American mothers who lived in affluent neighborhoods were likely to stay longer on welfare than African American mothers who lived in less affluent neighborhoods, while their white counterparts were better off in affluent neighborhoods. These findings suggest that racism or race-related discrimination hinders African American mothers' exit from welfare. Race is still a highly important research framework to understand the well-being of low-income mothers.

Implications for policy and practice

After welfare reform, empirical studies revealed that child care subsidies substantially accelerated TANF exits to employment (Cochi, Ficano et al., 2006). Every month in FY 2012, families of almost 1.5 million children utilized child care assistance and most states gave TANF families first priority for child care assistance (Office of Child Care, 2014). Almost 70% of those children received care in center-based settings. However, not all of the eligible children whose parents received TANF benefited from child care subsidies. Also, whether subsidized child care facilities are truly accessible to individual participants has been overlooked by most researchers. These results reveal that even under smaller monetary barriers provided by child care subsidies,

some Work First participants had limited geographical access to state-accredited child care that accepted child care subsidy, especially in rural and poor neighborhoods

Moreover, addressing this lack of child care facilities in poor neighborhoods is crucial, because as this study showed, access to child care facilities was more critical to length of stay in Work First for participants who lived in poorer neighborhoods than to those living in higher-income neighborhoods. This study provided a virtual map of social resources that low-income families often desperately rely on, and the map allowed policymakers and practitioners to locate most underserved areas in North Carolina.

This study also showed that the effect of geographic location of goods and services varied by race. These specific, individual-level findings suggest policymakers interested in tangible and concrete ways to improve the well-being of these vulnerable women and their children should carefully evaluate the geographical placement of services and supports, including new food bank outreach centers or child care centers.

With the finding that younger single mothers stayed on welfare longer than their older counterpart, this study suggests a more comprehensive approach is needed to enable younger single mothers who use welfare to overcome the disadvantages they face, including limited education, and a lack of social, emotional, and instrumental support from their familial and social networks. Additional fiscal and informational support is likely needed for young single mothers on welfare to complete their secondary education and secure stable employment.

The study finding also provided an important implication for practitioners. According to the multi-level modeling analyses, African American mothers who lived in affluent neighborhoods stayed longer on welfare than their white counterparts who also lived in affluent neighborhoods. Social workers and other practitioners should pay particular attention to

determining if these clients endure greater discrimination and how this racism or race-based discrimination impedes them from leaving welfare.

The investigation findings about the spatial distribution of quality child care centers, faith-based organizations and food pantries showed that women living in mountainous regions in the western and northern parts of North Carolina particularly suffered from a lack of access to these services. Policymakers should consider assertive measures to make these resources available to poor families. School measures could include expanding meals on wheels services, and offering incentives to child care providers to operate in these more rural areas child care providers to provide transportation to low-income mothers. Also providing transportation for single mothers who live in remote area would be a good solution. State government could assign the Child Care and Development Block Grant (CCDBG) and Social Services Block Grant (SSBG) to expanding current school bus system to low-income single mothers who live in remote areas and experience difficulties in securing reliable transportation to child care centers.

Implications for Research

One contribution this study makes to social science research is its effort to illustrate the complex nature of neighborhood effects. Some researchers have argued that neighborhood effects - for example, the effect of a high concentration of low-income residents - is not felt homogeneously among residents; rather, individual characteristics such as race and gender may moderate this neighborhood effect (Browne, 2000; Gilbert, 1998). The present study findings showed that the neighborhood effect of affluence (i.e., high concentration of residents with income more than \$50,000) on length of stay in Work First is mediated by geographic accessibility of child care facilities that accept subsidies. In light of these findings, neighborhood

studies should explore specific cases or conditions where neighborhood effects had variable impact on individual outcomes (Casciano, 2007).

This study provided explanation of unexpected result of MTO project and suggested better intervention to promote well-being of people lived in underprivileged neighborhood. The final MTO evaluation disappointed many researchers and policymakers, because it found MTO had no effect on adult participants' economic self-sufficiency and children's academic performance even though MTO had a dramatic effect on adult physical health. Experimental group participants experienced statistically significant weight loss and less suffered by diabetes than the control group (Ludwig et. al., 2013). It was striking that MTO didn't consider racial composition of the neighborhoods where program participants moved into. These findings suggested that racism or race-related discrimination hinders African American mothers' exit from welfare. Race should be still a highly important research framework to understand the well-being of low-income population.

Race was significant term in understanding the effect of geographical resource availability. The study showed the effect of proximity to high quality child care facilities was different by Work First mothers' race. Whereas Work First mothers who were not White or African American who had better proximity to child care facilities showed a quicker exit from Work First, African American mothers who had better proximity showed slower exit. This result may be related to different patterns of child care utilization by women of differing racial or ethnic backgrounds. Further studies should address what low-income single mothers desired from their child care providers and how they compromised when they actually made child care choices.

The outcomes of this study also suggest another direction of future research. An important aim will be to disentangle the multifaceted nature of neighborhood effects and the complex mechanisms that determine outcomes. This study showed neighborhood economic status didn't have equal influence on women from different racial backgrounds. Rather, better economic status in the neighborhood had a positive effect on mothers from other racial and ethnic groups, but it had a negative effect on African American mothers. Neighborhood economic status may be a more important contributor to people's well-being than researchers have previously concluded.

This study also provided an example of academic research with administrative data. This study graphically examined three layers of administrative population data—1) the residential locations of Work First participants in North Carolina, 2) the characteristics of the neighborhoods where Work First participants live, and 3) the geographic distribution of several services that are relevant to low-income mother's employment. These services included state-accredited child care facilities that accept subsidies, non-profit social service agencies (e.g., faith-based organizations, charitable food service organizations, social service agencies). These analyses were undertaken to examine how the proximity of Work First families to these entities influenced mothers' exits from welfare. Given that there are elevated requirements from federal and state governments to track and maintain data about individuals, such administrative datasets are widely constructed and should be used more extensively for research purposes.

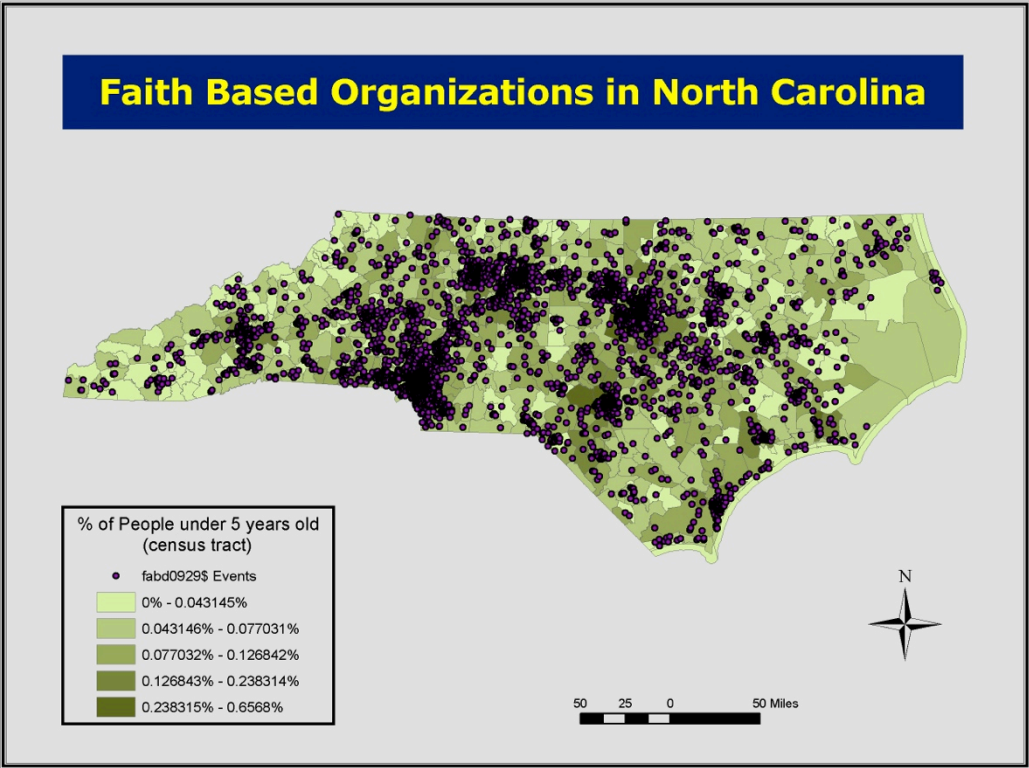
In addition, this study provided an example of applying GIS in social work research. Even though GIS was introduced long ago as a promising tool for social science research (Hiller, 2007; Robertson & Wier, 1998), few such GIS empirical studies have been conducted by social work researchers due to data confidentiality limitations. To conduct GIS analysis, data that

contain individuals' addresses are necessary, and privacy consideration bar most researchers from obtaining that level of information about social survey research participants. By using administrative data, this study overcame the confidentiality barrier. In fact, given recent advances in data security among federal, state, and local governments, it is becoming easier to utilize administrative data to conduct research that aims to provide a timely response to policymakers' needs. Nonetheless, this study illustrated one possible way to employ GIS technology in an analysis of administrative data.

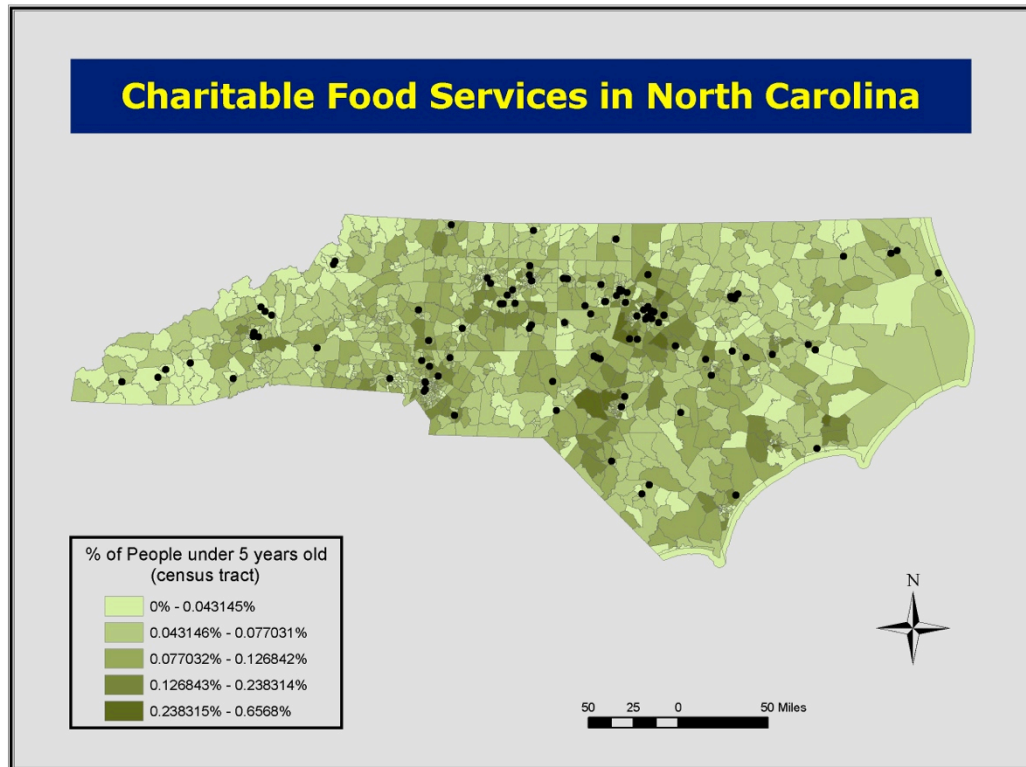
CONCLUSION

In summary, this study investigated neighborhood characteristics and the accessibility to quality child care facilities and social services on the length of stay on Work First in North Carolina. Neighborhood has long been considered an important contributor to the well-being of marginalized populations, but not fully appreciated due to methodological challenges. Given the expanded funding for child care subsidies in the post-welfare reform era, the effect of the accessibility of subsidized child care is not fully investigated. This study employed Geographical Information System to measure the accessibility to quality child care facilities in North Carolina. The key study findings are 1) the distribution of subsidized quality child care facilities was clustered, 2) some Work First participants who lived in rural areas had limited access to subsidized quality child care, and 3) better accessibility was more critical to Work First participants in poorer neighborhoods on their stay on Work First.

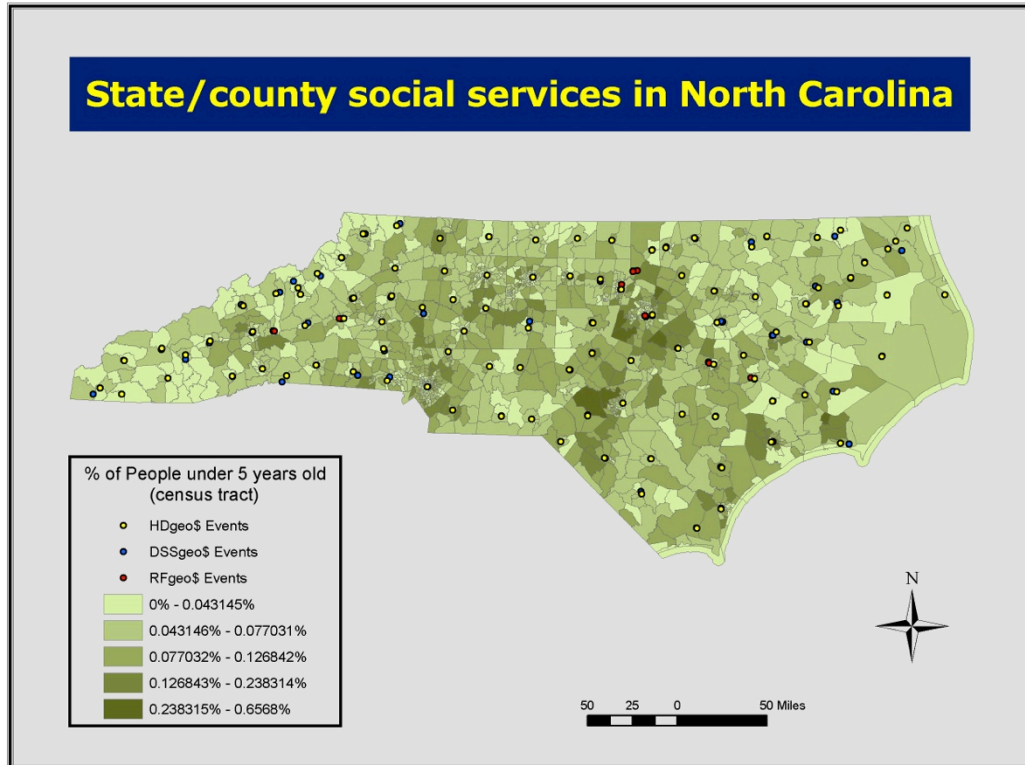
APPENDIX 1. LOCATION OF FAITH-BASED ORGANIZATIONS IN NORTH CAROLINA



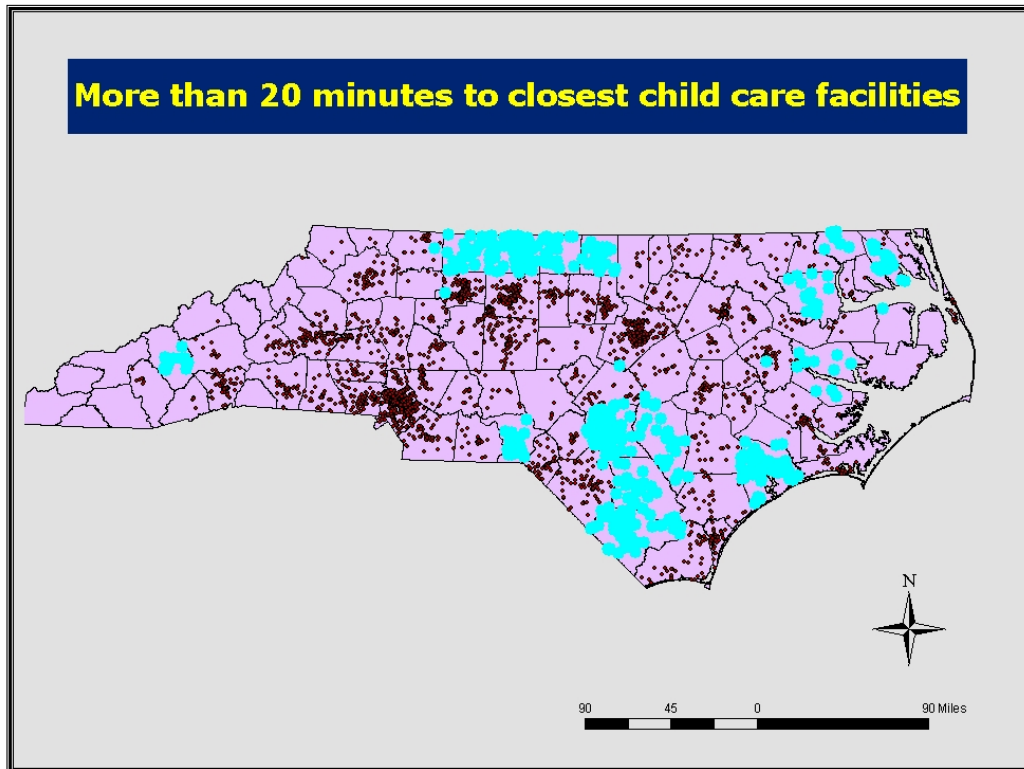
APPENDIX 2. LOCATIONS OF CHARITABLE FOOD SERVICE AGENCIES IN NORTH CAROLINA



APPENDIX 3. LOCATION OF STATE/COUNTY SOCIAL SERVICES IN NORTH CAROLINA



APPENDIX 4. WORK FIRST PARTICIPANTS WHO LIVE IN MORE THAN 20 MINUTES
TO CLOSEST CHILD CARE FACILITIES



APPENDIX 5. LWA CORRECTIVE COX MODEL WITH MAIN EFFECT WITH DATA
INCLUDING NOT GEOCODED SAMPLE

Variables	Description	Coef		Hazard Ratio
Individual level				
Age	Age	0.0093	***	1.0093
Black (dummy)	African Americans (1)	-0.1154	**	0.8910
Kid2 (dummy)	Having more than two children (1)	0.1481	**	1.1596
Tottime	Total travel time to 5 closest child care facilities	-0.001		1.0010
chtottime	Total travel time to 5 closest faith-based organization (church, temple etc)	0.0008		1.0008
fdtottime	Total travel time to 5 closest food banks, soup kitchens, or food pantries	0.0004	*	1.0004
dsstime	Travel time to county department of social services	-0.0042	p=0.075	0.9959
hdtime1	Travel time to county health department	-0.0019		0.9981
rftime1	Travel time to state residential facilities ADATC, developmental center,	-0.0018	***	0.9982

	neuro-medical center, regional hospital, school for people with hearing and vision disabilities			
Neighborhood Level				
pctl20k	% of household income less than \$20,000	0.2402		1.2715
Pctbl	% of African Americans	-0.2953	**	0.7443
pctm50k	% of household income more than \$50,000	0.0416		1.0425
Pctrmo_c	% of live in same county since 1995	-0.5585	***	0.5721

*** p<0.001, ** p<0.01, * p<0.05

APPENDIX 6. LWA CORRECTIVE COX MODEL WITH MAIN EFFECT AND
INTERACTION TERMS WITH DATA INCLUDING NOT GEOCODED SAMPLE

Variables	Description	Coef		Hazard Ratio
Individual level				
Age	Age	0.0092	***	1.0092
Black (dummy)	African Americans (1)	-0.0928	*	0.9113
Kid2 (dummy)	Having more than two children (1)	0.1564	**	1.1693
Tottime	Total travel time to 5 closest child care facilities	-0.0005		0.9995
chtottime	Total travel time to 5 closest faith-based organization (church, temple etc)	0.0005		1.0005
fdtottime	Total travel time to 5 closest food banks, soup kitchens, or food pantries	0.0004	p=0.06	1.0004
dsstime	Travel time to county department of social services	-0.0041	p=0.069	0.9959
hdtime1	Travel time to county health department	-0.0016		0.9984
rftime1	Travel time to state residential facilities ADATC, developmental center, neuro-medical center, regional	-0.0018	***	0.9982

	hospital, school for people with hearing and vision disabilities			
Neighborhood Level				
pctl20k	% of household income less than \$20,000	0.1229		1.1308
Pctbl	% of African Americans	-0.3063	**	0.7362
pctm50k	% of household income more than \$50,000	0.3118		1.3659
Pctrmo_c	% of live in same county since 1995	-0.5395	**	0.5831
Interaction				
black*tottime	African Americans*total travel time to 5 closest child care facilities	0.0031	*	1.0031
black*pctm50k	African Americans*% of household income more than \$50,000	-0.5990	*	0.5494
kid2*tottime	More than 2 kids*total travel time to 5 closest child care facilities	0.0027	0.09	1.0027

*** p<0.001, ** p<0.01, * p<0.05

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